AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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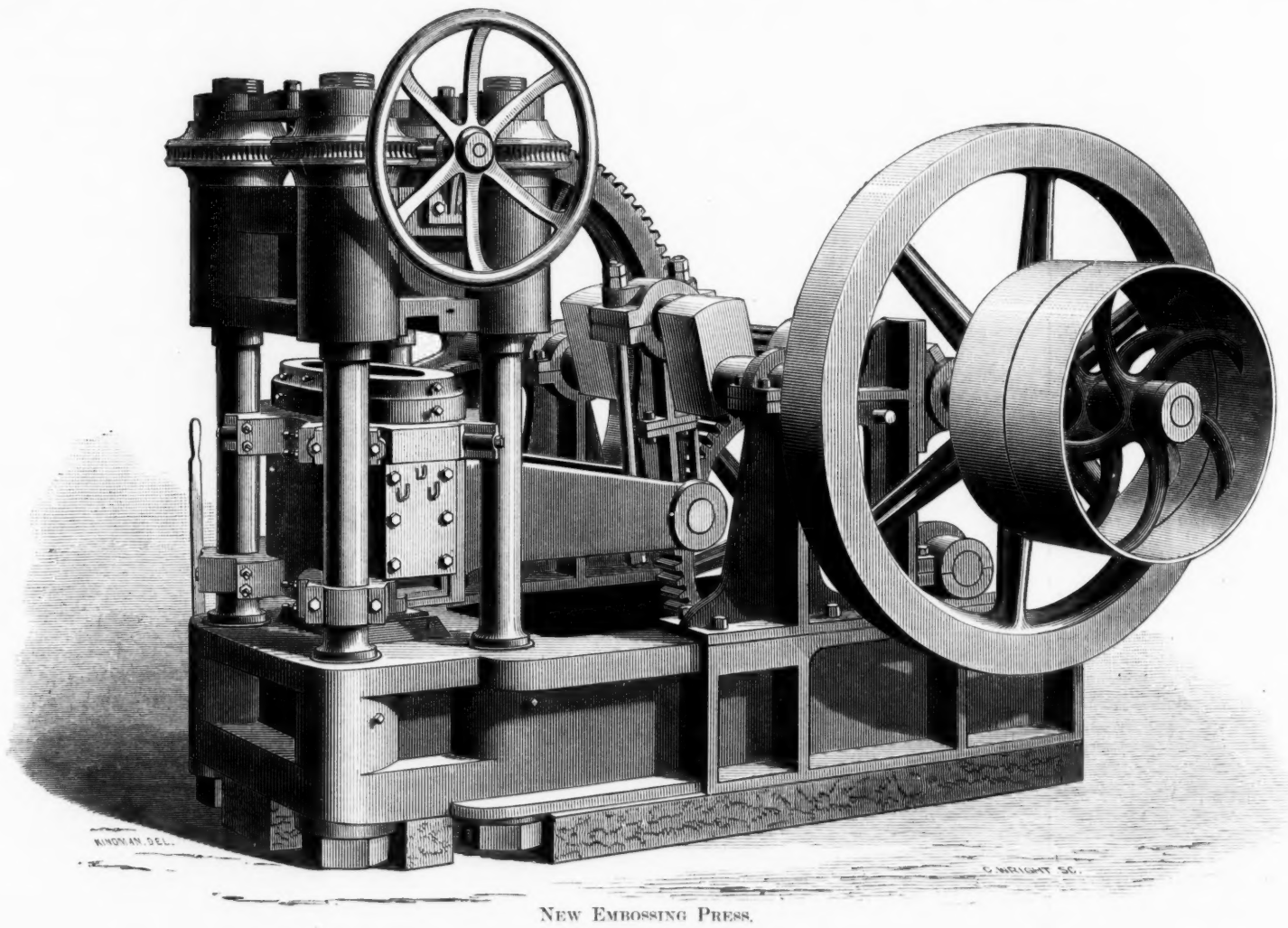
New Embossing Press.

The embossing press shown in the cut is designed to take the place of a drop for such work as embossing the handles of silver spoons, forks and ladles, and for stamping medals and like varieties of heavy work. It is built with a heavy bed to sustain the action of the press. Four steel posts or columns, which are 5″ in diameter at the narrowest part, and bear the principal strain, support a heavy cross head, which is held in position and adjusted by four heavy nuts, on which is cut a worm gear actuated by the hand wheel as shown. This gear affords an easy, positive and extremely delicate adjustment, one one-thousandth of an inch ($\frac{1}{1000}$) being easily within the measure of adjustment gained if desired. A notable feature of this machine, as a mechanical contrivance, is the ease and accuracy with which these four nuts are actuated at the same time by a single motion of the wheel.

The hand lever in front of press is arranged to operate the friction clutch that connects the driving shaft with the train of gears, giving the operator perfect control of the working parts, stopping in middle of the stroke if desired.

The large arm or lever in the center of the machine is connected with the crank shaft, in such a manner that the whole strain is borne by the wrought iron—both shown in the engraving. This arm or lever is connected with a toggle joint, which is encased to keep it safely out of the way, giving an upward motion to the lower die, while the upper die remains stationary, a method which reverses the usual plan of construction in metal-working presses.

This press will give one thousand tons pressure, and will receive dies with face 2 inches wide by 12 inches long, or 4 inches in diameter. It weighs, complete, about 11 tons, has an adjustment of 3 inches, and motion of 2 inches. The balance wheel is 63 inches diameter, weighs 1,440 lbs., and should run at 200 revolutions per minute. This press is made by Bliss & Williams, Plymouth, Pearl and John Streets, Brooklyn, N. Y.



NEW EMBOSSING PRESS.

Novel Manufacturing Enterprise.

According to an Elgin, Ill., paper, a watch manufactory is to be established within a year in that town upon a very novel financial plan. The company enters into a contract with the leading and substantial jewelers throughout the country to furnish its watches to those dealers for a term of twenty years, company's option, at a discount of fifteen per cent. from jobbers' prices, the jewelers, for this concession, depositing the sum of $200 cash with the company, to be used as working capital until the new company is firmly upon its feet. It is said that such progress has been made that one hundred and twenty-five contracts have already been entered into, and $25,000 thus pledged by contract. Enough additional contracts, it is claimed, will be made soon to raise $40,000, when the factory will be erected and work commenced.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * It has become the habit with a certain class of machine designers to neglect and belittle certain little conveniences and nicknoddles, whose true utility has been established beyond all doubt.

I have been there myself, but have never attempted to analyze the motive which prompted the suppression of really useful "traps" about a machine. I think, now, that the action is governed by the same law of commerce which allows surfaces, that should be finished, to be painted; which allows a mud-colored paint, called steel color, to be used, instead of good machinery paint and varnish; the said commercial law of design being that it is folly to put anything useful or ornamental on a machine which is not absolutely requisite in order to render it salable.

* * * * Almost any one, who has had anything to do with machinery, will have noticed that many little conveniences, which are of real utility, are often omitted on what is known as the best makes. I believe it to be true, that the worse a machine is in general respects, the more of such details will be found. I believe it is considered the proper thing for high-class machine builders to use the word "meretricious" in regard to such details of the work of competitors, meaning thereby that such things are simply the empty, vulgar flauntings of prostitution. Personally, I have long since come to the conclusion that a machine is none the worse for some attention paid to apparently trifling details of convenience, and, at the same time, I am forced to the belief that what we call the best builders pay the least attention to such things. From what I have seen of machinery, if I were offered a machine which at first sight presented many little painstaking details of convenience, I would at once want to look into the workmanship and know if things were round and square and flat and strong. I do not think it true that all good tools have the little conveniences omitted, or that all tools with little handy traps on them are bad.

* * * * Many of the so-called conveniences of machine tools, for instance, are of very doubtful utility, when the additional complication is considered, and any builder is, of course, justified in giving himself the benefit of the doubt by saving their cost. Furthermore, the machine buyer is too often a man who, while he has a hundred men running machines for him, has never run one himself, and has never watched the operation closely while some one else was running one. Such a buyer will not invest ten cents in little things which appear to him to enhance only the comfort and convenience of a workman. He overlooks the fact that manufacturing capacity consists of men and facilities, either of which may be of little or great value. If the views above indicated were carried far enough in the same direction, it would suggest that the machine itself need not be purchased.

* * * * Some years ago, some brilliant genius of a machinist conceived the

happy idea of drilling a hole in the tail stock of a lathe, to hold oil for use on the centers. Half of the lathe builders now incorporate this hole into the design of their lathes. The cost of the thing is about fifteen cents, and its value, by a direct saving of money, is about that much per day. Every lathesman knows that when he has his elbow crooked under one end of a heavy job, and is just ready to screw the tail center up, and needs some oil, the oil can be always at the other end of the lathe or on some other lathe, or almost anywheres out of reach. The hole in the tail stock is a special oil can, just where needed, and one which cannot, under any circumstances, get away. The drill-shaped oiler kept in this hole, delivers a single drop in the center of a job, while an oil can, of any construction of squirt, will deliver the one needed drop on the center, provided you can reach the oil can, and not less than sixty drops on the floor. Here is a big percentage of gain in oil.

* * * * Question: First.—As a conservator of force and material, with proportion in view, is the reaping machine a more important or perfect or valuable invention than the oil pot on a tail stock? Question: Second.—Why do the "other" tool builders leave the oil pot off tail stocks?

* * * * Once on a time I ran a lathe, or spent much time trying to run one, and under one of the carriage-wings was pivoted a little chalk cup, exactly like the cups on billiard tables. I thought, at first, that some fellow had stolen the thing from some saloon and put it on the lathe, but a little investigation showed me that it had been calculated for when the lathe was designed. It was a good institution, well worth modern consideration. I wrestled with this lathe about four months, and I solemnly declare that the before-mentioned chalk holder was the only good thing about it. This chalk cup was past all criticism. Its convenient location, its freedom of opening, its marvelous capacity to hold chalk nicely, its novelty, and its general existence were all to be commended; but the other parts of the lathe—may I never see or hear of their like again! What the designer had neglected in the way of general viciousness, the builder and years of wear had made complete. I do not remember what the swing of the lathe was, or pretended to be. All lathes have a swing, of course, but this had several of them. It was one swing at the face plate, another at the tail stock; one swing over the carriage, when it fed in one direction, and another when it fed in the other direction, besides an infinite variety of swings as you picked out different crooks in the bed. The tail stock had a set-over movement, and several undesirable erratic movements in addition.

The tail spindle didn't fit, and never had fitted, and it had a different traverse every day. You never could know how far back it would be drawn, or how far out it would go. The tail stock hand wheel had two handles in it—enough for two lathes, while this was no lathe at all.

Both centers were fitted in square holes, but not in the same square hole, by any means.

The carriage was composed largely of tool post and cog gearing. As nearly as I can remember, the tool post reached all the way down to the saddle. It was so limber and springy that, long after you threw the feed out, the tool post would continue to urge the tool forward. The apron gearing was all on the outside, and there was lots of it. It was never safe to reach down to take hold of anything without a good look first, on account of the danger of grabbing something built on the nut-cracker style. There was machinery on that apron which had been a failure when the lathe was new, and all of it had been tinkered with and remodeled and altered, and all the old stuff left. I never pretended to understand the thing.

Among the other element of the feeding mechanism was a rack which moved endwise on the lathe, sliding between the two front V's. A hole in the wall allowed the projecting end of this rack to go out into the foundry once in a while, and a general spirit of shiftlessness allowed the foundry hands to hang all manner of plunder on it. It didn't make much difference, because it wouldn't work anyhow.

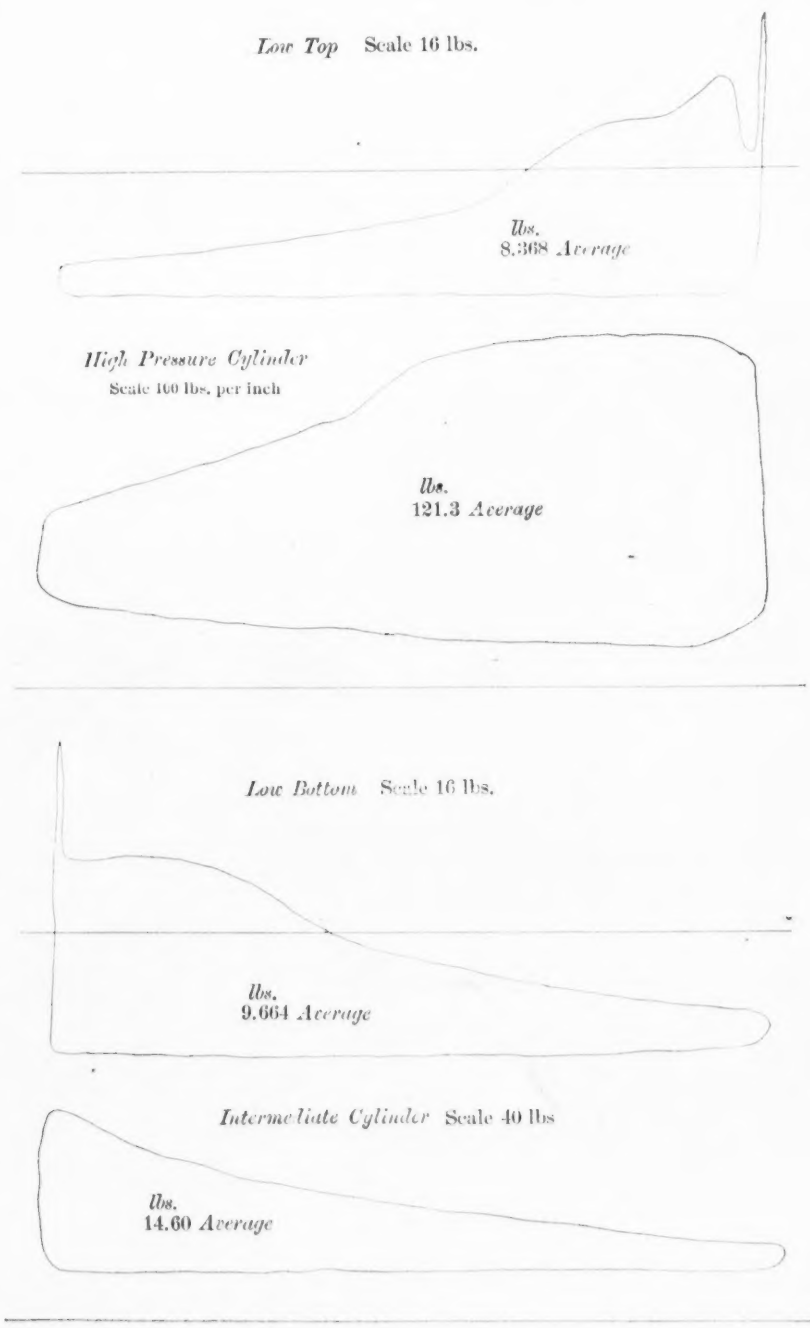
The head gearing was all cast, and the pitch was so coarse that a broken tooth now and then didn't alter the appearance any. The method of throwing the back gear out of action was at once simple and effective. All you had to do was to take a wrench and unscrew some things, and take the whole back rigging off and throw it on the floor.

If it was off, I seldom bothered to put it on, and if it was on, I generally let it alone. It didn't make any difference, anyhow. This was the case with most all the details of the lathe. It didn't make any difference what you did, the thing would still produce, or fail to produce, the same effect. The tail stock was just as apt to be stiff and steady when loose as when screwed down tight. No scientific manipulation of anything would have the least effect on chattering. If the lathe didn't feed, it was hard to make it do so, and if it did feed, it was sometimes impossible to stop the feed without stopping the lathe. There was nothing about the lathe, always excepting the chalk cup, which was not as bad, or even worse, than skillful intention could make it.

I got four dollars a day for running that lathe, and would not do it again, under the same circumstances for twice the money. With my present knowledge of the money-saving qualities of decent tools, I would not pay a good man twenty-five cents a day to run it for me. I got four months' pay for doing about three weeks' work on the miserable old tool, and I earned my money, but the man who paid me might have half paid for a good lathe out of the increase of production. The work I did on this old lathe was as good as I usually did, but it annoyed me, and cost the bosses lots of money.

* * * * Very respectfully,

CHORDAL.



Navy Yard Tests of the Anthracite.

The following are extracts from the report of the board of United States Naval engineers, who were appointed to test the English steam yacht, "Anthracite." The experiment was made at the Navy Yard, in Brooklyn, N. Y., Aug. 13th and 14th, 1880.

"The experiment was made with the vessel secured to the wharf, the test being solely for the purpose of ascertaining the cost of the horse power in water and coal.

"The engines and boilers were managed by the engine force of the vessel, and the data collected, indicator diagrams taken, and observations made during six consecutive hours by a watch composed of three naval engineers. The coal, which was bituminous, was from the Powelton Mine; of good quality; was filled in bags, containing 100 lbs. net each, and brought to the dock, the coal bunkers having been previously sealed. An employee of the yard brought the coal on board, a single bag at a time, as it was wanted, and passed it below, reporting it to the senior engineer on watch, who recorded it, and also the time at which it was sent below. At the end of each watch, as a check on the record, the empty bags were counted and sent on shore. No errors or omissions were discovered. The ashes were hoisted out dry, and weighed on the wharf by the senior engineer of the watch. The feed water was weighed after its delivery from the condenser, and before it was pumped into the boiler. For this purpose a tank was especially constructed. It was of boiler plate, and divided into two nearly equal parts, by a vertical water-tight plate. In the top edge of this plate, a horizontal rectangular notch (6″ long and 2″ deep) was cut, by which the height to which each half of the tank could be filled was determined. The mean weight of water each compartment of the tank held, when filled, was 680 pounds, at a temperature of 74° Fahrenheit. In the computations, corrections have been made for the difference in weight between water at this temperature and the mean temperature of the feed water. One of the main engine feed pumps was disconnected from the boiler, and its discharge pipe led above the measuring tank, where it terminated in a swinging return bend. By a slight movement, the opening could be turned over either compartment of the tank, into one or the other of which, at will, this pump discharged the condensed water from the hot well. The other feed pump was disconnected from the hot well, and its suction pipe led to the bottom of the two compartments of the tank, through a cock on each, so that the contents of either could be drawn out and discharged within the boiler.

"The method of measuring the water and recording it was as follows: One side of the tank having been filled, the swinging pipe was turned so as to discharge into the other. When the water in the full compartment settled to the height of the edge of the notch, the cock in the feed pipe was opened, and its contents pumped into the boiler (obviously, care was taken to empty the compartment in less time than it took to fill the other). When empty, its feed cock was closed. When the water in the compartment being filled reached within a few inches of the top of the notch, a gong in the engine was sounded once, to call attention, and, when it reached the edge of the notch, the gong was struck twice. At this instant the assistant engineer in the engine room noted the reading of the engine counter, and, immediately afterward, the height of the water in the boiler. The attendant at the tank noted the time at which each compartment was filled, keeping the record of each separately, and recording the temperature of the water in each compartment, when half emptied. After entering the reading of the counter, the senior engineer of the watch ascertained the numerical difference between that and the preceding entry, and if it was far from the average of these differences, the cause was sought for. By this system of checks, any errors of record could have been detected. All parts of the tank pipes and cocks were plainly visible, and any leaks were easily seen. There was one of four drops per minute in the feed pipe from the tank, and one of about twice this quantity in the pipe leading to the tank. The drip from this last leak was collected for six hours, and found to be 1½ lbs. The water lost in the circulation to and from the engine and boiler was replaced by adding measured quantities to the tank that was being filled. The added water was, therefore, measured in the tank and charged in the cost. At the end of the trial, the water in the boiler and in the hot well was brought to the height at which it stood when the trial commenced. These quantities are also charged in the line of water evaporized. The indicators were tested before and after the trial, and their scales accurately ascertained. Diagrams from the working ends of each cylinder were taken every half hour. The recorded data, utilized and tabulated, commenced at the moment a compartment was filled, and ended also as a compartment was filled. The weight of water in the last compartment enters into the quantity given as total five water, but not the weight of water contained in the first one. The thickness of fuel in the furnace was the same at the end as at the beginning of the trial, as nearly as could be determined by the eye. The covers of the high and low pressure cylinders were removed before commencing the trial, and steam was admitted on one side of the pistons. They were found to be quite tight. Lack of time prevented more than the one test, herein recorded, being made, as it was

important that the vessel should soon start on her return to England."

The table which should here be published, as well as the results obtained during the Navy Yard experiment, on account of space will be deferred until next week. We, however, publish reduced engravings, Figs. 1 and 2, showing the construction of the boiler, which was described, giving dimensions, etc., in our issue of Sept. 4, 1880. The diagrams shown are designated as Set 3, and are taken from Mr. Bramwell's report. The boiler pressure was 360 pounds; number of revolutions per minute, 39.78. They are a fair average of those taken during his experiment. We will publish a set in our next issue which were taken during the Navy Yard experiment, so that a comparison of the two sets can be made.

Letters From Practical Men.

NOTES ON THE ENGINE LATHE.

Editor American Machinist:

I suppose no one doubts that the engine lathe will always remain the leading tool of the machinist. I suppose, however, that no one considers it perfect. The commonest of occurrences in the shop is the wish that, in some particular, the design of a certain lathe might, to suit the job of the moment, be just a little altered. But then, this incident is not necessarily a condemnation of the lathe. Where is the man who has not sometimes wished for a third hand? (A second head would be an improvement to some people.) Yet the human frame is a pretty creditable piece of work.

The remarks of Mr. Chas. T. Porter upon strength in machine tools are, as far as they go, proper and timely, and they apply especially to the lathe. Every mechanic of experience knows how the solidity of a lathe tells upon both the quality and the quantity of its work. The pet tools in every shop are the heaviest ones. Comparing the tools that I remember when I first went into the shop with the best tools of to-day, I note a marked improvement in this respect. Further progress in the strength of tools will result from a better appreciation of its importance by those who buy and use the tools rather than by those who make them.

I would have a lathe strong, and next to that I would have it capable of as great a variety of work as possible. I am speaking of *the* lathe. The invention of lathes for special work has not narrowed the field which the ideal lathe is to occupy in the least. I do not wish to enter into any controversy about combination tools, though the objection to them on general principles seems to me a flippant one. The choice usually does not lie between the combination tool and the several special tools whose functions it assumes. The choice is rather between the combination tool and nothing at all. A gear cutting attachment to a lathe, for instance, is often a prize to a shop, which cannot afford a full-fledged gear-cutter.

I want a lathe to have a swinging headstock, hollow spindle, compound screw-gears, a Sellers, or some equivalent variable feed, cross feed and feed for tail stock. I want, at least, all these, and in about the order named. I never happened to strike a lathe combining all these points. No one need consider me exacting in my requirements, for the list of what I would *not* have on a lathe would be a much larger one. A lathe combining the particulars which I mention might not, perhaps, be the most salable one a builder could offer, but if thoroughly made and run by a first-class man, it would be harder to get it out of a shop than to get it in.

Then, in designing a lathe, more attention might be given to the facility of operating it. Men should be ambidextrous, but they are not, so the hemi-demi-semi quavers should be assigned to the right hand, as they are on the piano. The right hand should not be employed to move the carriage along. That should be for the left hand, while the right manipulates the tool. Using the right hand to move the carriage also, crowds the man to the wrong side of the rest, and especially for chuck-work, he has not as good a view of the tool. When the lathe is set up the shipper should be set for the left hand, though it seldom is, and on account of it, I have known impatient men (I am one of them) to acquire the habit of stopping and starting by handling the cone belt.

I have often wondered why lathe builders do not have on their lathes one improvement, which would cost nothing. Why not make the travel of the carriage self-measuring? I have measured the lathes of several makers, and I find that most of them give nearly one inch (say 1⅛″) of travel for a revolution of the crank, but none of them do it exactly. Now, if it were exactly an inch, the workman could measure the travel of his carriage by counting the turns of the crank, and so get his measure from one shoulder to another, or between any points that he wished to measure on his work, more accurately than by his rule, and without even stopping the lathe. I said that this improvement would cost nothing; it would incidentally do the lathe a service; it would necessitate a cut rack, and crowd out the cast racks, which are an abomination. The hub of a crank should carry an adjustable collar, graduated to give the fractions of an inch, and so that it could be set to a zero point on the apron, whatever the position of the crank happened to be. On my lathe, when I build it, I shall have a collar like this upon the cross screw of the rest, and also upon the screw of the tail stock. Then I shall be able to make a two-foot rule last longer.

This measuring crank would also be serviceable in cutting screws. Let the tool run up so far as you want to, stop the lathe, unlock the nut on the lead screw, move the carriage back any number of inches required, lock the nut again, and then go ahead, and never waste your time in running the lathe backward.

FRANK H. RICHARDS.

Troy, N. Y., Nov. 27.

SCREW THREADS.

Editor American Machinist:

An improved form of screw thread may be made by rounding the point of the threading tool. This thread can be used where the bolts are cut in a lathe, and will be but a trifle more expensive than the common form of thread; while the taps and screws will be stronger—a matter of considerable importance. Such taps will be less likely to crack in hardening. On the same principle, taps should be grooved with round cutters.

H. NORTON.

Bernardstown, Mass., Nov. 29, 1880.

The Standard Screw Thread Question.

The following letter from Mr. F. A. Pratt properly forms an addition to the discussion of Mr. Stetson's paper on "Standard Screw Threads," which was published in our issue of November 27. As Mr. Pratt did not remain until that paper was presented in the Society meeting, he has embodied his part of the discussion in the letter herewith:

Editor American Machinist:

Unfortunately I did not find it convenient to remain during the entire session of the meeting of the American Society of Mechanical Engineers, held at the Union League Theater, New York, on the first of this month, yet I have had the pleasure of reading the proceedings of the meeting in your paper. All of the papers read before the Society were interesting to me, yet I would name among those in which I took the most interest, the address of our President, that of Coleman Sellers, on the "Metric System of Measurement," and that of Mr. Stetson on "Screw Theads," the latter subject interesting our company, at the present time, more than any other, for the reason that, for the last twelve months, we have been at work on this thread-gauge subject.

Perhaps you will get a better idea of what we have done, or rather what there was and still is to do, when I inform you that we have employed seven or eight of the best mechanics we can get to construct the apparatus; and, not only have we these men, but we also have one of the best men that Prof. Thurston has turned out at his institution, to lay out and superintend the work. We are not relying altogether upon our own resources, but are having the assistance of Prof. Rogers, of Cambridge, who is, perhaps, better posted on the subject than any other man in this country. It may not be generally known that one of the principal reasons for our engaging in this business was on account of an application, from the Car Builders' Association, for a perfect set of screw gauges, the production of which finally fell to us, and by consent of all parties concerned. We had previously made these gauges, but after strictly investigating the matter, together with a thorough examination of the various measuring machines now in use, we not only became dissatisfied with our own, but with all other apparatus also, and have started, we think, from the foundation; and our expectation is not only to give accurate measurements and size gauges, but also true screws, and thread gauges ground to perfect pitch and size, after being hardened.

I do not write this for the sake of being advertised, or of advertising the business of my company, but simply to let those who are interested in this subject know what is being done, and also to inform those who already know what we have attempted, that we have not abandoned the project, but expect to complete the machinery so that we can produce these guages and correct screws early in the spring. We cordially invite all our friends who are interested in the matter to call on us; we are anxious to have them do so, as we feel that we need their advice and all the assistance they can give us. We expect to submit the results of our labors in this business to the best authority that we have in this country, to such men as the members of our Society of Mechanical Engineers and the Franklin Institute, and ask for their verdict. We would gladly have said nothing regarding what we are doing until we could show results, were it not that it seemed necessary under all the circumstances to make it known.

We hardly expect to attain perfection, but we hope to be able to show our friends "the reason for the faith that is in us," and also hope to be able to convince them that our standard is worthy of being adopted, if it is shown to be nearer perfection than others, and has the sanction of our best authorities, and we will labor hard to induce other manufacturers to adopt it, or we will adopt the standard of other makers if greater accuracy and precision can be shown; for we do not expect, nor even wish, were it possible, to take all the business in this direction—we ask a small share only. But what we do desire is *one standard throughout our country*, and to this end we are willing to work early and late until it is accomplished.

We expect within four or five months to have our apparatus finished and its productions ready for inspection, at which time we shall give due notice.

Respectfully yours,
F. A. PRATT, President,
The Pratt & Whitney Co.
Hartford, Conn., Nov. 26.

FIG. 1.

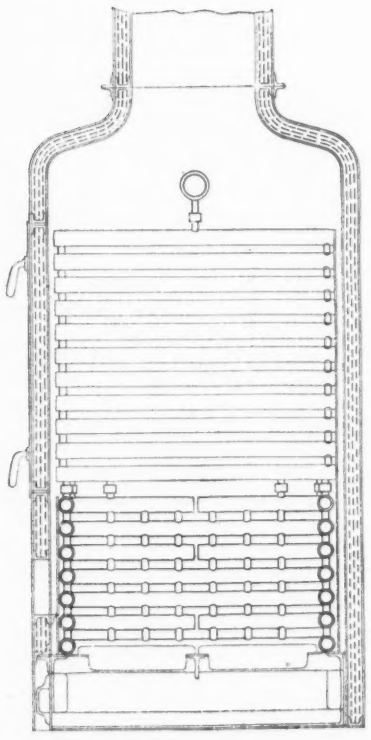
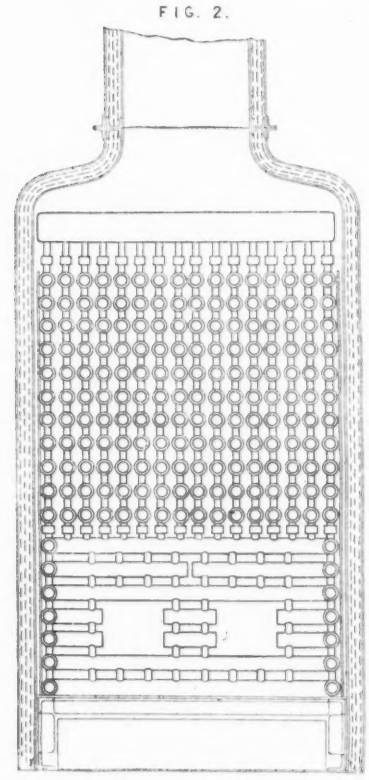


FIG. 2.



BOILER OF THE ANTHRACITE.

The Latest Electric Lamp.

The Maxim lamp, which is mentioned as accomplishing the results sought for by Mr. Edison, is an incandescent lamp, having a filament or conductor, which is placed in a glass globe from which the air has been exhausted and replaced by the vapor of gasoline. If there is any weak point or thin part in the carbon filament when the current is passed through it, this point or part will become hotter than the rest, and will decompose the gasoline so as to deposit carbon in the form known as coal-gas carbon upon that particular spot. When this spot has been built up to an equal conductivity with the rest of the filament, the current from the machine is increased with the effect of seeking out the next weakest point or thinnest part, and repeating the process just described. In this way the filament becomes glazed with gas carbon. The gasoline is then withdrawn from the globe, and the lamp is ready for use.

Newly Incorporated Massachusetts Companies.

Glen Woolen Co., North Adams; Sandford Blackenton, President; Frank A. Walker, Treasurer. Capital, $100,000, in shares of $100 each. For the manufacture of goods of wool, cotton, silk and flax, and of any or all said materials combined, and with other materials. Nov. 26.

The Haverhill Iron Works, Haverhill; J. George Little, President; Edwin Bowley, Treasurer. Capital, $10,000, in shares of $100 each. To establish an iron foundry, and to carry on the general manufacture of iron. Nov. 29.

Leominster Furniture M'f'g Co., Leominster; Jared Whitman, Pres., Arthur J. Bates, Treas. Capital, $50,000, in shares of $100 each. For the manufacturing and buying and selling of furniture. Nov. 27.

The American Fire Hose M'f'g Company, Chelsea; Otis Hinman, Pres., Edwin E. Sibley, Treas. Capital, $25,000, in shares of $100 each. For the manufacture and sale of fire hose and apparatus generally connected therewith or with fire departments. Nov. 30.

The Sea Breeze Avenue Railroad Company, Coney Island, N.Y. has been incorporated by A. H. Battersby, Wm. H. Stilwell, D. J. McKinlay and others. Capital, $10,000, in shares of $100 each. To construct, maintain, and operate a railroad, commencing at a point near the Coney Island & Brooklyn Railroad, on Coney Island, and running thence easterly to and through SeaBreeze and Coney Island Avenues, to, and connecting with said Coney Island & Brooklyn Railroad. Length of road about one mile.

On Practical Methods for Greater Economy of Fuel in the Steam Engine.

BY ALLAN STIRLING.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

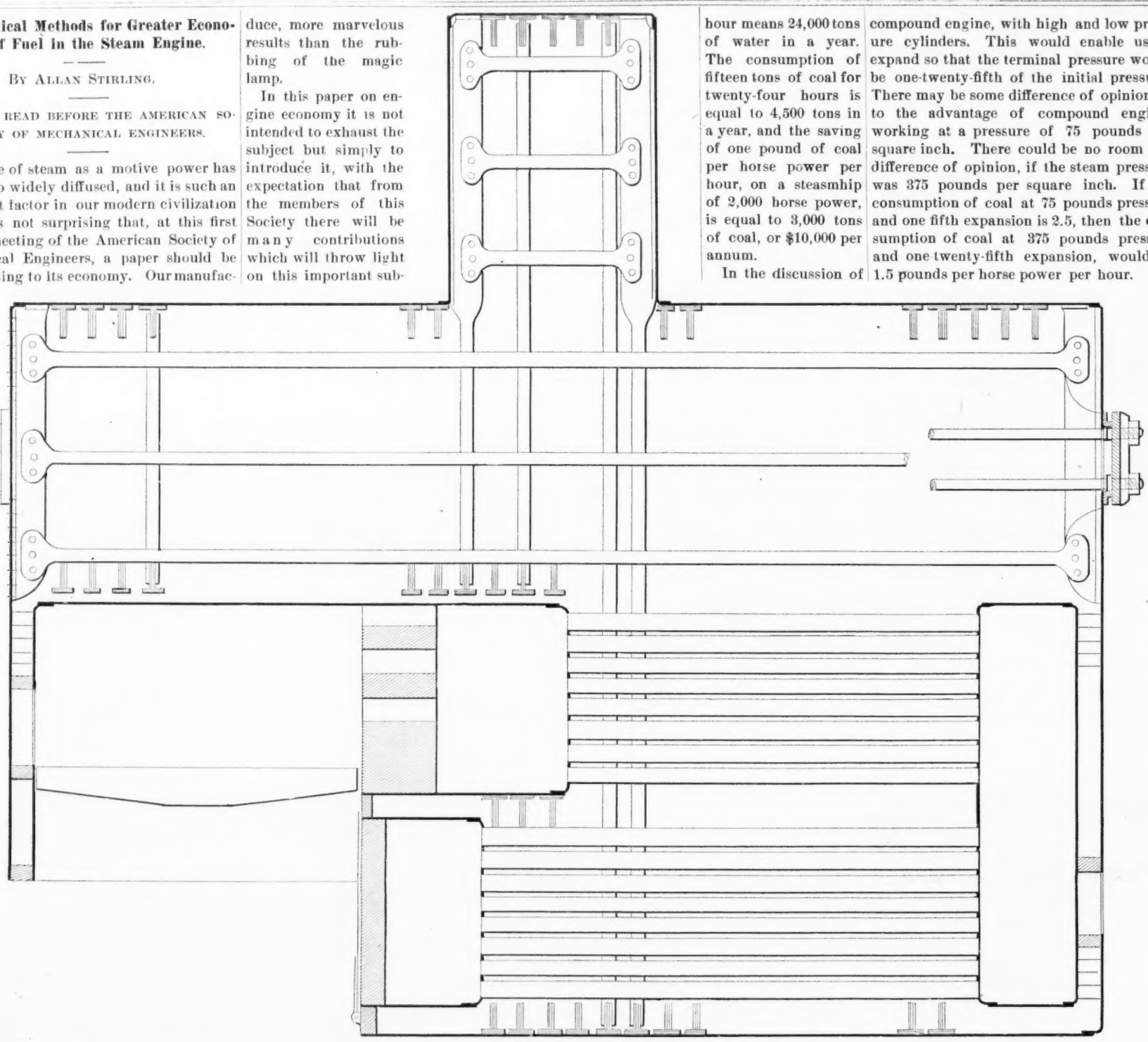
The use of steam as a motive power has become so widely diffused, and it is such an important factor in our modern civilization that it is not surprising that, at this first annual meeting of the American Society of Mechanical Engineers, a paper should be read relating to its economy. Our manufactories, railroads, and ships owe a debt, which is, perhaps, not fully appreciated, to this wonderful power; even the electric light, which promises such great things, depends on steam for its success. In my early days, one of the fables of the school books was about three giants representing wind, water, and steam; the marvels performed by the giant steam seemed impossible, and yet in these days those marvels are more than realized. In the "Arabian Nights Entertainment" we have the fable of Aladdin's Wonderful Lamp, and when we read it we think of it simply as a dream of the imagination; but this wonderful power of steam has produced, and will continue to produce, more marvelous results than the rubbing of the magic lamp.

In this paper on engine economy it is not intended to exhaust the subject but simply to introduce it, with the expectation that from the members of this Society there will be many contributions which will throw light on this important subject, in which every one of us is more or less directly interested. The motto of our profession is "Excelsior," and while we may look with complacency on the economic results already achieved, we should not be satisfied but aim higher.

In the discussion of this question it has been customary to speak of the engine and boiler separately, but to obtain the best results the two should be studied together; the one should be built for the other, and with a mutual relation the one to the other. In my practice I have come across engines that were all right for the most economical results, while the boilers would be so weak as to be only capable of carrying a very moderate pressure of steam. On the other hand, I have met with boilers that were strongly built and well designed in every respect, while the engine was so constructed as to waste the largest part of the power of the steam. In the folowing paper it is my intention to discuss the engine and boiler as parts of the whole mechanism for the production of power, and in their mutual relations the one to the other.

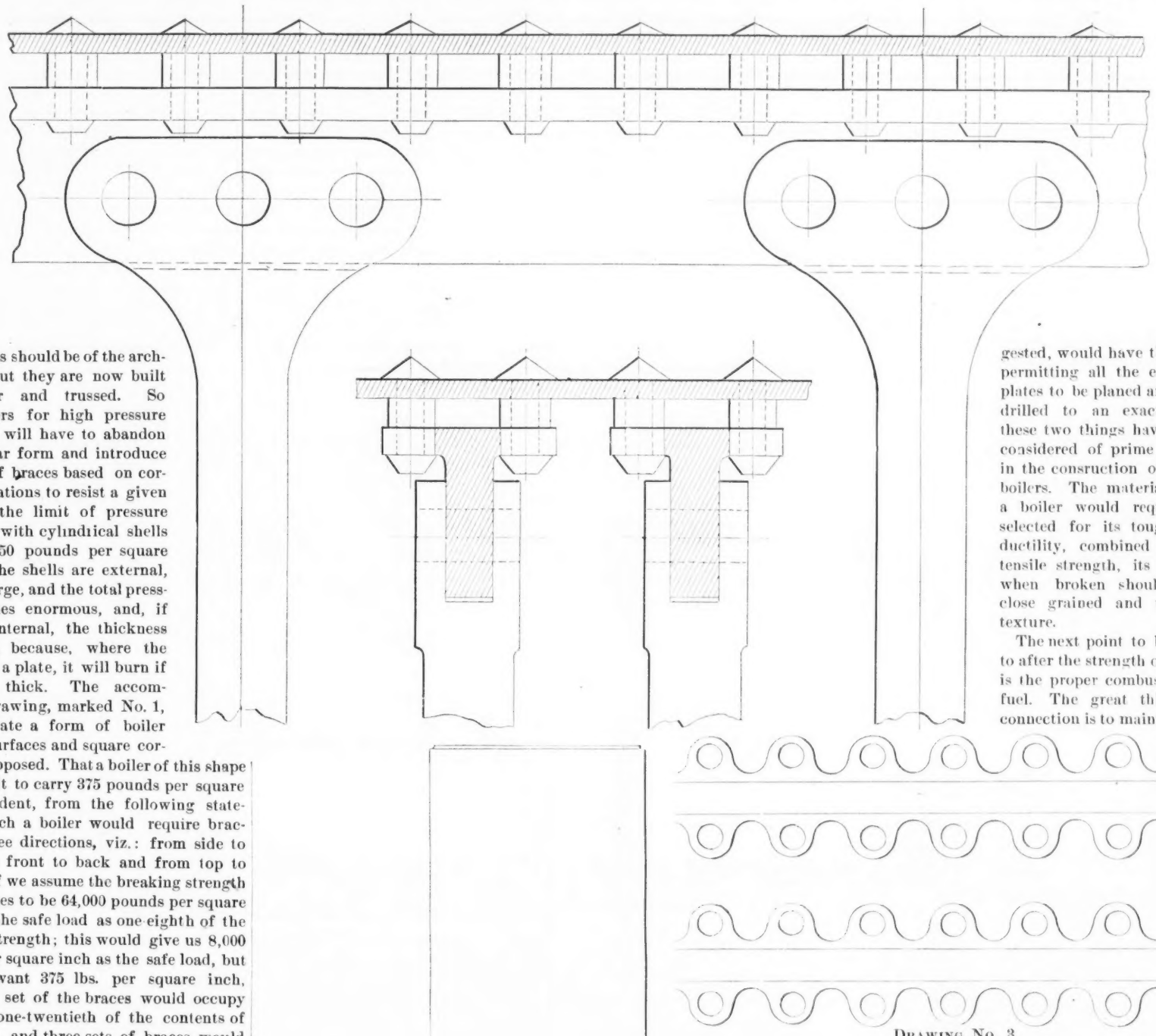
In designing and constructing our motive power we should keep in mind the importance of the work that is before it. One hundred revolutions a minute mean 144,000 revolutions in twenty-four hours. The evaporation of 100 cubic feet of water an hour means 24,000 tons of water in a year. The consumption of fifteen tons of coal for twenty-four hours is equal to 4,500 tons in a year, and the saving of one pound of coal per horse power per hour, on a steasmhip of 2,000 horse power, is equal to 3,000 tons of coal, or $10,000 per annum.

In the discussion of steam power, the first question that presents itself is "What pressure of steam shall we carry?" Of course, the higher the pressure the greater the economy, but that is indefinite. Where shall we stop? When Watt left the steam engine the pressure carried did not exceed fifteen pounds per square inch. The average pressure now carried in practice is somewhere about seventy-five pounds per square inch, or about five times the pressure used by Watt. This increase of pressure and consequent expansion has resulted in a marked economy. While Watt used ten pounds of coal per horse power per hour, we are regularly working with about 2½ pounds of coal per horse power per hour. You will all agree with me that the adoption of a still higher pressure and a greater expansion will result in still greater economy, and it has seemed to me that at the present stage of progress, and with the materials at hand, we may go to five times as much pressure as we now carry. With the materials at our hand, we can make boilers that will work at a pressure of 375 pounds per square inch, and with this pressure to begin on, we can make an economical compound engine, with high and low pressure cylinders. This would enable us to expand so that the terminal pressure would be one-twenty-fifth of the initial pressure. There may be some difference of opinion as to the advantage of compound engines working at a pressure of 75 pounds per square inch. There could be no room for difference of opinion, if the steam pressure was 375 pounds per square inch. If the consumption of coal at 75 pounds pressure and one fifth expansion is 2.5, then the consumption of coal at 375 pounds pressure and one-twenty-fifth expansion, would be 1.5 pounds per horse power per hour. But how can we build a boiler that will successfully continue to carry that great pressure? No part of the science of engineering deserves more care or forethought than the designing or constructing of boilers, and, perhaps, it is more neglected than any other. It is a common practice to make drawings for boilers with the outlines only marked, but the staying and bracing (the most important part of all) is left for the foreman of the boiler shop to fill in. With our present and prospective high pressures, every rivet and stay should be carefully designed and clearly marked. In designing a boiler to carry 375 pounds per square inch, there are several things to be considered in addition to the strength. There is the proper combustion of the fuel; the absorption of the heat by the water; the separation of the steam from the water; the facilities for cleanliness and inspection; the weight and space occupied; the cost and the durability.



DRAWING NO. 1.—SECTIONAL ELEVATION.

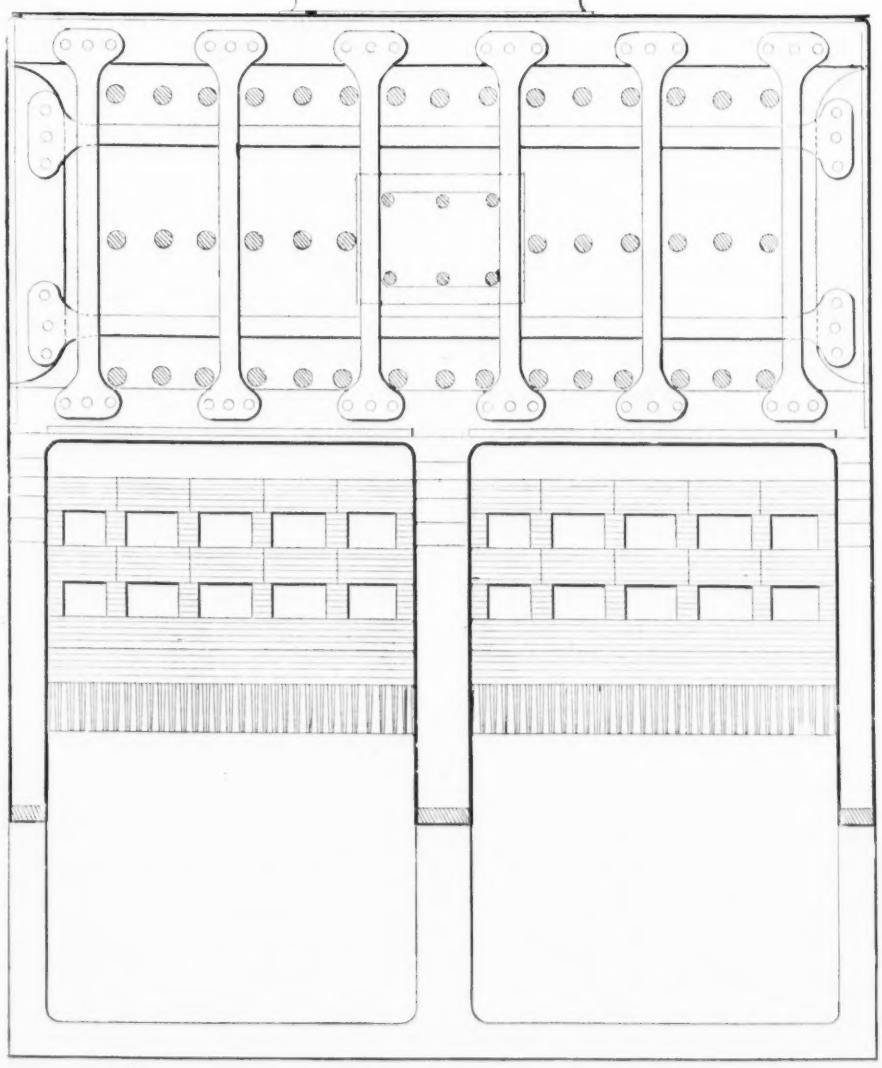
First: Let us consider the strength. In a book for boiler makers, published in England, the following language is used: "Rectangular forms or flat surfaces are all weaker than the tubular form," and the London *Engineering*, in describing a boiler, states, that "one of the principal advantages is, that there are no flat surfaces to be stayed." Formerly bridge builders insisted



DRAWING NO. 3.

that bridges should be of the arched form, but they are now built rectangular and trussed. So with boilers for high pressure steam, we will have to abandon the circular form and introduce a system of braces based on correct calculations to resist a given pressure; the limit of pressure for boilers with cylindrical shells is about 150 pounds per square inch. If the shells are external, they are large, and the total pressure becomes enormous, and, if they are internal, the thickness is limited, because, where the fire strikes a plate, it will burn if it is too thick. The accompanying drawing, marked No. 1, will illustrate a form of boiler with flat surfaces and square corners, as proposed. That a boiler of this shape can be built to carry 375 pounds per square inch is evident, from the following statement: Such a boiler would require bracing in three directions, viz.: from side to side, from front to back and from top to bottom. If we assume the breaking strength of the braces to be 64,000 pounds per square inch, and the safe load as one-eighth of the breaking strength; this would give us 8,000 pounds per square inch as the safe load, but we only want 375 lbs. per square inch, hence one set of the braces would occupy less than one-twentieth of the contents of the boiler, and three sets of braces would only occupy one-seventh of the contents of the boiler, leaving six-sevenths for steam and water. Referring again to drawing No. 1, and detail drawing marked No. 2, a system of braces and *T* beams will be seen, which are arranged so as to leave large space between the braces for the purpose of inspection. With reference to the crown sheets an objection may be made to this arrangement—that so much of the surface would be covered with iron that it would interfere with the circulation; but by having considerable space between the *T* bars and the crown sheet, this objection would be overcome, especially when it is remembered that there would be $1\frac{1}{4}$ inch of space for circulation to $5\frac{1}{4}$ inches of heating surface, while in the water legs of locomotive boilers, as now built, there is only about three inches of space to thirty inches or more of heating surface. In addition to this the wings of the *T* bars can be scalloped out between the rivets, as shown on detail drawing marked No. 3. Where the plates are close together, as in the furnace legs, etc., the ordinary locomotive practice is to put $\frac{7}{8}$ screw stay bolts, $4\frac{1}{2}$ inches between centers for a pressure of 125 pounds per square inch, for a pressure of 375 pounds per square inch, the distance would require to be $2\frac{3}{8}$ inches centers for equal safety. The plates would be $\frac{5}{16}$ or $\frac{3}{8}$ thick, as at present, and the stay bolts might be made hollow for greater safety. Building the boilers square and without curved surfaces, as suggested, would have the effect of permitting all the edges of the plates to be planed and the holes drilled to an exact template; these two things have long been considered of prime importance in the consruction of first-class boilers. The material for such a boiler would require to be selected for its toughness and ductility, combined with great tensile strength, its appearance when broken should be fine, close grained and uniform in texture.

The next point to be attended to after the strength of the boiler is the proper combustion of the fuel. The great thing in this connection is to maintain the furnace at a uniformly high temperature. To do this it is necessary to have a mass of fire-brick in the furnace; there should be a combustion chamber, the furnace should be placed near the top of the boiler and there should be dampers to shut off each furnace. Unless attention is given to these things there will be a great loss of fuel when the furnace is replenished with coal. When the furnace door is opened, if there is no damper, the cold air will draw through, the heat will continue to be absorbed by the water very rapidly, if the furnace is at the bottom of the boiler, and if there is no reservoir of heat stored in fire-bricks, the temperature of the furnace will be lowered and much of the gases from the fresh coal will pass off cold and unconsumed. On the other hand, if there is a damper very little cold air will enter when the door is opened, if the furnace is near the top of the boiler, the absorption of the heat by the water will proceed more moderately, and the reservoir of heat in the fire-bricks will maintain the temperature of the furnace and ignite the gases from the fresh coal. These statements are based on the well-known fact that gases are burned much more perfectly when the oxygen and carbon are at a high temperature. The furnace being at the top and surrounded by water, at a comparatively high temperature, would assist materially, even when the door was shut, in maintaining the temperature at a higher point than it would if near the bottom of the boiler and surrounded by cold water. To this fact of the high temperature of furnace, and perfect combustion of gases, is to be attributed the comparatively good results obtained from the water-tube boilers and the cylindrical tubular boilers set in brick work. While not approving of the building of our furnaces entirely of brick, as in the boilers last named,



DRAWING NO. 2.—CROSS SECTION THROUGH FURNACE.

we should have enough fire brick in our bridge walls to act as a reservoir of heat for the proper heating of the gases, and a combustion chamber where the gases can be thoroughly ignited before entering the tubes. (See drawing No. 1.)

The third point to be considered is the absorption of the heat by the water. The main things in this connection are to have the gases escape from the boiler at a low temperature, and to have clean surfaces of the metal for the water to come in contact with. The gases should escape at the bottom of the boiler where the cold water is, and we should use surface condensers for all engines. If the gases escape at the bottom of the boiler, they can be comparatively cold and still impart heat to the water; and if we use surface condensers we will not be troubled with scale. It has been found that a scale one-sixteenth of an inch thick requires an expenditure of fifteen per cent. more fuel. As the scale thickens, the ratio increases; at one quarter inch thick it adds 60 per cent. to the fuel required. Our locomotive engineers will say, "We cannot use surface condensers;" but there is no reason why the surface condenser could not be carried on the tender instead of the great quantities of water that are now carried, and the water for condensation picked up and dropped as they go along. In cold weather it might even be possible to condense by means of the cold air current, caused by the motion of the train. The saving of coal, which might be expected on our locomotives from the vacuum, the clean boilers and the greater degree of expansion, would be enormous, and is worth looking after.

The next thing that we have to consider is the separation of the steam from the water. To do this effectively, there should be a large area of water level, large steam room and a good dome. Every one who has designed boilers with cylindrical shells knows how impossible it is to get as much area of water level, or as much steam room, as they would like. By constructing our boilers with vertical sides, as shown on drawing No. 1, the water level will be the full size of the boiler, and the steam room and steam dome can be made of any size desired, and the steam would be effectually separated from the water.

The fifth point to be considered is the facilities for cleanliness and for the inspection and repairing of the boiler. These should be ample. One of the difficult and disagreeable duties of an engineer in charge of steam boilers is to squeeze in through a manhole, made as small as possible, and then when he is in it, is next to impossible to move, much less to thoroughly inspect, repair and clean the boiler. When we think of a boiler that will carry 375 pounds per square inch, we are confronted with the question, How is such a boiler to be constructed so as to permit of easy access for the above purpose? The manholes would be placed in the ends of the boiler, and made with a number of braces running the whole length of the boiler, and holding the manhole plates together. These braces would have collars on, so as to keep the plates from being drawn together when the nuts are screwed up. This would give us two openings into the boiler of any desired size, one at each end. The braces holding the manhole plates would be removed. This would not only allow the engineer to go in but would give him space and ventilation, so that he could stay in until the work which he went in to do was satisfactorily completed. The surfaces of the manhole plates would be ground. Another factor in this connection is that boilers that have no surface condensers attached become scaly. The operation of scaling is at the best a partial, tedious, and difficult one, consequently the effectiveness of the boiler is continually being impaired to a greater degree. The general use of surface condensers would entirely prevent this great nuisance.

Lastly, we have to consider the questions of weight, space occupied, cost, and durability. The weight and cost of this boiler per square foot of heating surface would be greater, but the weight and cost per horse power would be less than at present. As the power of the boiler would be increased nearly 100 per cent., we could afford to pay for best qualities of materials. The space occupied by the boiler and fuel per horse power would only be about half what it is at present—for locomotives and marine boilers this is a matter of prime importance. The durability would not be any less than our present boilers, the furnaces particularly of locomotives would last much longer because of the absence of scale. When scale is present the plates are highly heated and soon become brittle.

Having already occupied more time than I intended, I will close by briefly stating some other points which should be carefully attended to in order to secure the most economical results. The passages for steam should be large, short, and direct; the loss by radiation should be prevented by the most efficient jacketing; the valves and pistons must be tight; we must have quick-moving pistons and all moving parts thoroughly balanced; the percentage of engine friction must be reduced to as low a point as possible; all pumps should be run at a moderate speed, and by the main engine.

A frequent cause of loss is the failure to jacket the cylinder heads, the cylinder heads of most engines being polished bright and exposed to the air. They should be as well protected with jackets as any other parts with which the steam comes in contact.

For high pressure steam the slide valve will be found the most satisfactory, as it is constantly wearing itself tight. The locomotive engineers use the highest steam, and they prefer slide valves. They must be balanced, however, and there are several ways of doing this. Packing rings on the back of the valve are used largely by the Grand Trunk Railway, and the piston balance is used by Worthington on his pumps.

The use of steam packing for pistons will not answer for high pressures, the ordinary three-ring packing is preferable.

The beam engine promises to again become popular on account of its being so well balanced and its low percentage of engine friction, even for propellers, as in the case of the steamship "Louisiana," of the Cromwell Line, designed by Mr. John Baird. All the pumps should be run by the main engine, because it is a very economical motor, and will do the work with greater economy than independent engines. The pumps should also be run at a moderate speed, because water is incompressible, and much power is lost by moving it quickly. Steam is one thing and water a very different thing, as all engineers know.

In conclusion, I beg to call attention to the loss of such a large percentage of the power of the fuel in the condensing water. Can we do anything to prevent this loss? We know how beautifully Siemens has succeeded, by means of the regenerative principle, in preventing the loss of heat escaping up the chimneys, in our iron and steel works, and returning it to the furnaces. Is it possible to take the heat out of the steam while condensing and return it to the furnace, and thus realize a very great economy of fuel?

FIG. XII.

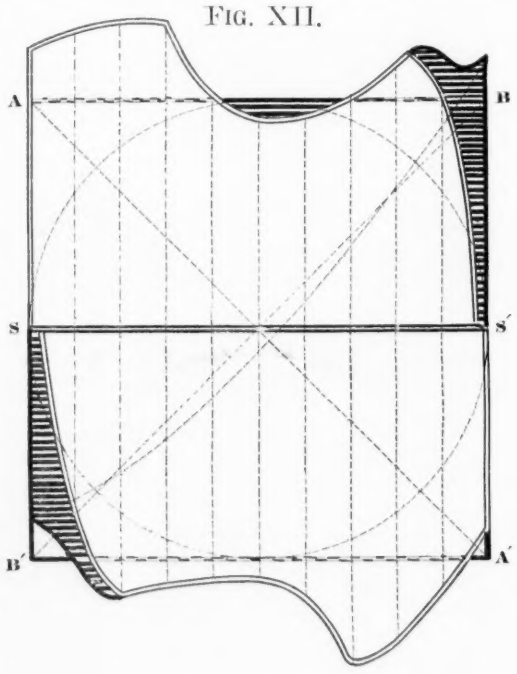
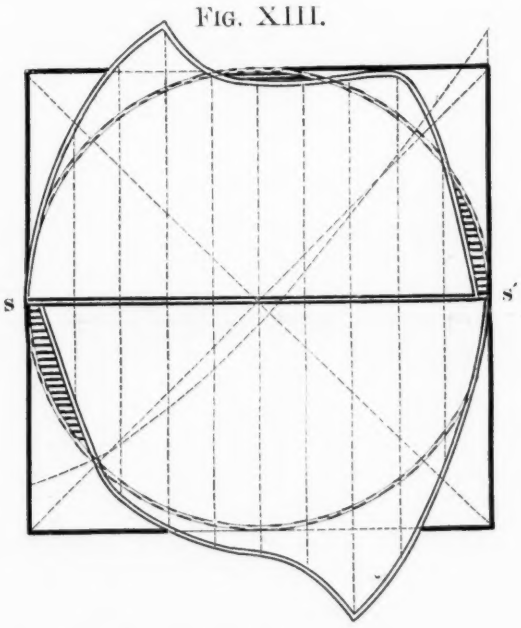


FIG. XIII.



An iron exchange is to be opened in Pittsburg. There will be large storage yards where pig iron, blooms, rails and other products of similar character can be stowed and certificates issued similar to those issued on oil, and grain in elevators. These certificates will be a merchantable financial commodity, and transferable.

It is said the inexhaustible iron and lead deposits in China have tempted a British company to establish extensive yards in the "Celestial Kingdom." Already over 3,000,000 tons of coal, and perhaps as much iron ore, are mined in that far-off empire. The over-stocked population makes it possible to secure skillful workmen at from twelve and a half to twenty cents per day.

It is said that a project has been formed to build a line of road from Fort Worth to Laredo, on the Rio Grande, having a close identity with the Texas Pacific and the Missouri, Kansas and Texas. It is reported that Mr. Jay Gould is the moving spirit in the enterprise, and that several millions of Eastern capital are pledged to its completion.

The Chattanooga and Rome Railroad Company has been organized to build a railroad from Chattanooga, Tenn., to Rome, Ga.—63 miles. The road will probably be extended to Atlanta.

The Northwestern Lumberman says: The mill men of the continent can look back over a season unexampled in the success it has afforded them, and a majority of them have only themselves to blame if they do not enter upon the rigors of the winter season with a good bank account.

The Albany press report great activity in the lumber business this season. The shipments have been as much as 250,000,000 feet. They expect to have 80,000,000 or 90,000,000 feet left in Albany at the close of navigation.

The Northern Pacific Railroad Company have secured from a syndicate of capitalists a series of loans, aggregating forty millions of dollars, for the purpose of speedily completing the road through to the Pacific coast. This means business for many machine shops.

High Ratios of Expansion and Distribution of Unequal Pressures in Single and Compound Engines.

BY J. C. HOADLEY, C. E.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Continued from last issue.

Fig. 12 is similar to Fig. 9, but is modified by introducing the disturbing effect of the angular vibration of connecting rod. Notwithstanding the slight departure from symmetry due to this cause, the approximation to the original square $A\ B\ A'\ B'$, is quite close, and the horizontal pressure on the crank-pin is still nearly uniform.

Fig. 13, shows the rotative effect under the same modifying influence of the vibration of the connecting rod, in direct comparison with both the square of uniform horizontal pressure, and the circle of rotative, tangential pressure corresponding thereto.

Now, before applying the principles here illustrated to the action of steam pressure in a compound engine, let us see what such a pair of ordinary diagrams would be capable of doing.

Suppose the engine, represented in action by them, to be a locomotive engine, with cylinders 15¼ inches diameter and 24 inches stroke, piston rod 2½ inches diameter; the mean net area of piston will then be 180 square inches, equal to 1¼ square feet, the volume swept through by a single piston at one stroke will be 2½ cubic feet, and by both pistons during one entire revolution of the driving wheels, 10 cubic feet. If these driving wheels be 5½ feet diameter, and if the speed be 25 miles per hour, the rotatory speed will be 125 revolutions per minute, and the piston speed 500 feet per minute. Our initial pressure is 104 pounds above atmosphere, say 118.7 absolute; cut-off is at 28 per cent. of the stroke from dead center, terminal pressure, if expansion were carried to the end of stroke, would be 36.11 pounds, the ratio of expansion 3.3, mid-stroke pressure 50 pounds; back pressure, exclusive of compression, 16 pounds, and including compression, 17.91 pounds; and mean effective pressure, all allowances made for wire drawing, early release and compression, is 52 25 pounds.

It follows that the indicated power of both cylinders will be 285 horse power. The quantity of steam expended per hour, compression allowed for, will be 6,120 pounds, equal to 21.4 pounds per horse power per hour; and allowing for steam condensed in doing work, 624 pounds per hour, we shall have a total of 6,762 pounds per hour, equal to 23.7 pounds per horse power per hour.

This is, of course, a very good result, rarely much surpassed by more complicated engines; and it is due, of course, to the assumption of dry steam. "Put your trust in God," said Cromwell to his Ironsides, "and keep your powder dry." I can recommend no safer place of trust, but to the engineer would say, "By all means keep your steam dry!"

Returning now to the action of steam in a cylinder, with ultimate reference to the compound engine: If the circle in Fig. 14 represents the orbit of a crank, and the horizontal diameter SS', the stroke of a piston; and if the square be taken to represent uniform piston pressure, and the circle the corresponding rotative effect, then will the diagonals of the square divide the revolution of the crank into quadrants, two of which may be called mid-stroke quadrants, and the other two, end quadrants; in the former 90.9 per cent. of the pressure is rotative, and only 9.1 per cent. non-rotative; in the latter only 48.7 per cent. is rotative, and 51.3 per cent. non-rotative. Of the whole pressure throughout the revolution,

64.3 per cent. in mid-stroke quadrants is rotative, and 6.4 per cent. non-rotative; and 14.3 per cent. in end quadrants rotative and 15.0 per cent. non-rotative.

These results which are geometrically accurate, as far as the third place of decimals (tenths of one per cent.), may be tabulated thus:

	PARTS IN ONE HUNDRED.		
	Rotative.	Non-Rotative.	Total.
End Quadrants. . . .	64.3	6.4	70.7
Mid-stroke Quad'nts.	14.3	15.0	29.3
	78.6	21.4	100.0

In the figure, the dark shading shows the non-rotative pressure; the light shading shows the rotative effect in the end quadrants, and the white space shows the rotative effect in the mid-stroke quadrants.

Fig. 15 represents the above ratios by the relative surface of the black and white areas.

Fig. 16. One-tenth of the circular area of rotative effect is here covered by the black annulus, the white space within, which shows the net rotative effect, upon the assumption that frictional resistance, per pound of piston pressure, is uniform throughout the revolution, and is equal to 10 per cent. of the indicated power.*

It also shows the relative value of this net rotative effect in the mid-stroke quadrants and in the end quadrants. The inequality is now greater than before. Of the whole net rotative effect, 85.2 per cent. is in the mid-stroke quadrants, and only 14.8 per cent. in the end quadrants. Of the gross rotative effect, 76.7 per cent. is usefully exerted in the mid-stroke quadrants, 13.3 per cent. in the end quadrants, and 10 per cent. is consumed in friction, about equally divided, upon our assumption, among all the quadrants. Of the whole power, as estimated by steam pressure, multiplied by piston area and by piston velocity, 29.3 per cent. is expended in the end quadrants in producing 14.8 per cent. of the net rotative effect and in overcoming one-half of the friction, and 70.7 per cent. is expended in the mid-stroke quadrants in producing 85.2 per cent. of the net rotative effect and in overcoming the other half of the friction. Relatively to the power developed in the cylinder, the net rotative effect is 2.4 times as great in the mid-stroke quadrants as in the end quadrants.

But this is upon the assumption that the friction, resulting from steam pressure on the piston, is substantially uniform throughout each entire revolution. Now, this resistance is probably considerably greater in the end quadrants than in the mid-stroke quadrants.

Steam pressure on the piston produces frictional resistance at four places, and in varying degrees in each, the value of this resistance, per unit of pressure, being directly as the velocity of the frictional surfaces, the coefficient of friction being assumed to be uniform, say, as for unctuous surfaces, 8 per cent.

At the cross-head pin the motion is small, being inversely as the length of connecting rod to radius of cross-head pin; but it is most rapid at dead centers, and 70 per cent. of the whole motion takes place in the end quadrants.

On the slides, the pressure is reduced from piston pressure in the ratio of crank to connecting rod, and the velocity is a maximum at mid-stroke, 70 per cent. of the motion falling within the mid-stroke quadrants.

The crank pin moves with velocity substantially uniform, in a path longer than the piston path, in the ratio of $\frac{1}{2}$ to unity, say, 57 per cent. longer.

The friction here is uniform per unit of pressure, and varies with varying piston pressure, or, strictly speaking, with varying horizontal pressure on the crank pin, as modified by the inertia of the reciprocating parts. It is much greater in total amount in the end quadrants, with any considerable degree of expansion, and the inequality increases with the ratio of expansion. The vertical component of the inertia of the connecting rod also goes to augment friction on the crank pin.

The frictional pressure on the crank shaft is a resultant of the horizontal pressure acting through the crank at a varying angle, and the weight of the shaft, balance wheel, etc. On account of the considerable diameter of the crank shaft, the velocity of its surface is, in short-stroke engines, generally about as great as that of the piston, and frictional resistance, uniform per unit of pressure, is, in fact, greatest at dead center.

With uniform pressure, and uniform friction per unit of pressure, one-half of the frictional resistance at crank pin and crank-shaft journals, falls within the mid-stroke quadrants, and the other half within the end quadrants.

After some consideration of the above elements of the problem, I am almost convinced that there is, in all actual conditions of steam engine practice, a good deal more frictional resistance in the end quadrants; and with very high ratios of expansion, a very great deal more. I have not, I confess, completely worked out the train of calculation necessary to verify this if true, or to refute it if fallacious, so that I am not prepared to present, as I have done hitherto, absolute numerical results which cannot be attacked. The next figure (Fig. 17) is, therefore, presented as an illustrative diagram of a probable relation, and not as a geometric representation of an ascertained fact.

Fig. 17. The black border of the circle representing rotative effect is, as in Fig. 16, equal in area to one-tenth of the area of the circle, which forms its outer boundary; but its greater breadth at dead center, and its diminished breadth at mid-stroke, representing greater frictional resistance in the end quadrants and less in the mid-stroke quadrants, reduce the white area within the border to an ellipse with its major axis vertical, to represent the net rotative effect, transmissible beyond the crank shaft. Measured by the planimeter, this area shows that 87 per cent. of the net rotative effect is produced within the mid-stroke quadrants, and only 13 per cent. within the end quadrants; and that of the whole power developed in the cylinder by the mean effective pressure, 61 per cent. is rotative effect in the mid-stroke quadrants, and 9 per cent. rotative effect in the end quadrants; 8 per cent. frictional resistance overcome, and 22 per cent. is non-rotative, of which 7, say 15, per cent. is in the end quadrants, and 3, say 7, per cent. in the mid-stroke quadrants.

In other words, say 30 per cent. of the indicated power is apparently expended in the end quadrants in producing 9 per cent. of net rotative effect, and 6 per cent. in overcoming frictional resistance, while 15 per cent. is non-rotative, and in the mid-stroke quadrants 70 per cent. of the indicated power is apparently expended in producing 61 per cent. of net rotative effect, and in overcoming 3 per cent. of frictional resistance, while 6 per cent. is non-rotative. These results may be tabulated thus:

	PARTS IN ONE HUNDRED.			
	Net Rotative.	Fricti'nal Rotative.	Non-Rotative.	Total.
End Quadrants	9	6	15	30
Mid-stroke Quadrants	61	3	6	80
Total.....	70	9	21	100

(*Concluded in one more issue.*)

An International Congress of Electricians will be held at Paris on the 15th of September, 1881. The Congress will be preceded by an international exhibition of electrical instruments and appliances.

FIG. XIV.

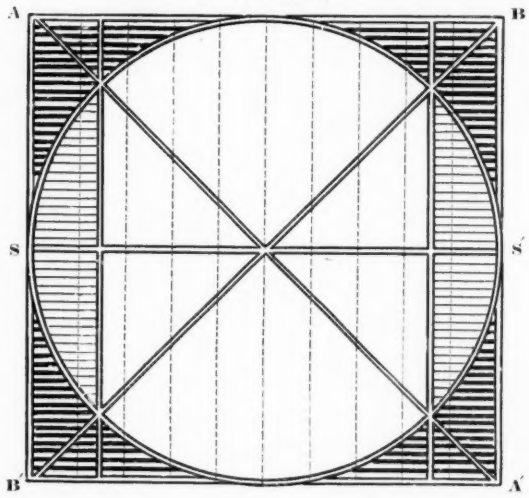


FIG. XV.

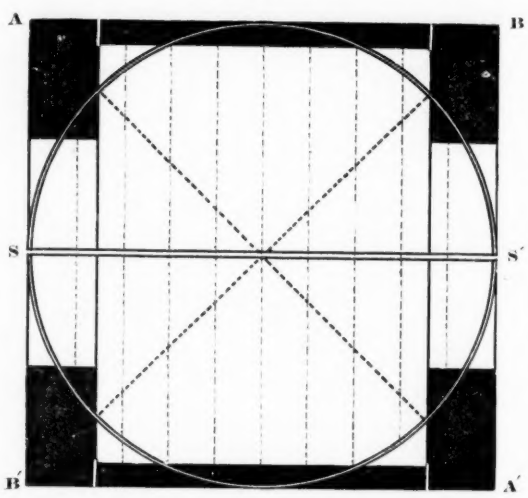


FIG. XVI.

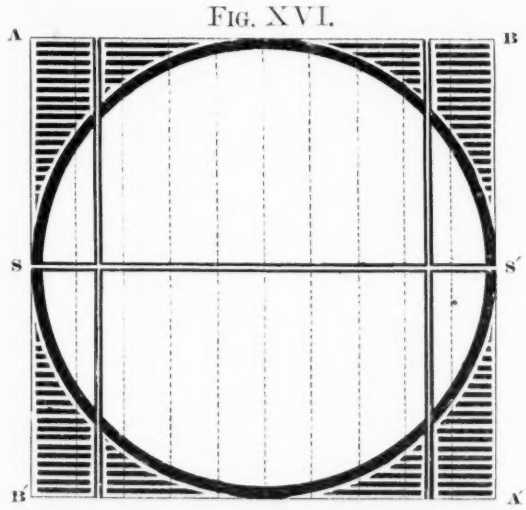
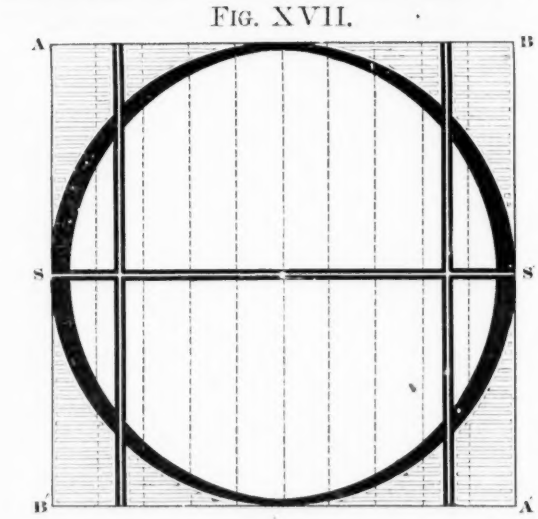


FIG. XVII.



*Rotary motion being supposed to be uniform, pressure on piston uniform, and frictional resistance per pound of pressure also uniform, it follows that the piston, moving more slowly near the dead center, will require longer time and a larger arc of crank motion to develop power equal to frictional resistance than at mid-stroke. It is believed that the black circle—the area covered by which bears to the area embraced by its outer boundary, the same ratio that frictional resistance bears to the total rotative effect—fairly integrates the result of these conditions. There may be, I admit, some fallacy in this, but I don't see it if there is. J. C. H.

Our foreign industrial exchanges have lately given considerable prominence to the peculiar qualities of a new metal, called "Arguzoid," an alloy to imitate silver and to supersede all silver plating and nickel plating. It is said to be superior to brass for all kinds of fittings, and, being solid metal, will always retain its brilliant appearance. We have just received some specimens of this new metal from the manufacturers, Thomson Sterne & Co., The Crown Iron Works, Glasgow, Scotland. It has a beautiful luster, and is easily kept clean. It casts as easily as brass, and loses none of its properties by the operation. The metal can be drawn out under the hammer, or rolled into sheets, and it is stronger than brass or phosphor bronze. It resists atmospheric changes in a wonderful degree. There seems to be a great variety of uses for this metal, which is as cheap as brass, plated with nickel or silver, and much more satisfactory where it has been tried.

Classification of Steels.

The Société Cockerill, of Seraing, Belgium, arrange their steels into four classes:

1st Class. Extra .mild steels. Carbon, 0.05 to 0.20 per cent.; tensile strength, 25 to 32 tons per square inch; extension, 20 to 27 per cent., in eight inches of length. These steels weld, and do not temper. Used for boiler plates, ship-plates, girder-plates, nails, wire, &c.

2d Class. Mild steel. Carbon, 0.20 to 0.35 per cent. Tensile strength, 32 to 38 tons per square inch. Extension, 15 to 20 per cent. Scarcely weldable, and hardens little. Used for railway axles, tires, rails, guns, and other pieces exposed to heavy strains.

3d Class. Hard steel. Carbon, 0.35 to 0.50 per cent. Tensile strength, 38 to 46 tons per square inch. Extension, 15 to 20 per cent. Do not weld, but may be tempered. Used for rails, special tires, springs, guide-bars of steam engines, pieces subject to friction, spindles, hammers, pumpers.

4th Class. Extra hard steel. Carbon, 0.50 to 0.65 per cent. Tensile strength, 46 to 51 tons per square inch. Extension, 5 to 10 per cent. Do not weld, but may be strongly tempered. Used for delicate springs, files, saws, and various cutting tools.—*From Abstracts of Ins. of Civil Eng.*

The Long Island Railroad has been purchased by Austin Corbin and other New York capitalists, and will be improved in equipment and management.

A New York farming and manufacturing association has selected 6,000 acres of land in Southwest Missouri on which to establish a colony.

Several flouring mills at Sherman, Texas, are to be converted into woolen and cotton mills. The uncertainty of the wheat crop in that locality, and the better chances for cotton and wool, are the sufficient reasons for the change.

The engines of the Kattyawar State Railroad in Western India are worshipped by some of the natives. A potter at Limri, having for a long time suffered from fever, and having failed to get relief from any of his old gods, at last contracted to place certain offerings before the "engine god" if that medium would bring him relief. Sure enough, the fever abated and he got well. So the potter has duly made offerings of cocoanuts and the like to the "god," much to the astonishment of the conductor and engineer of the train.—*Boston Transcript.*

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NEW YORK, DECEMBER 18, 1880.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

The World's Fair Enterprise.

After some months of what is called "work," since the incorporation of the World's Fair Commission, the grand project of holding an international exhibition in this city, in 1883, seems to have made no perceptible progress. At first, two rival and independent committees, each claiming to represent the great body of the people, drew public attention to the enterprise by persistently decrying each other through the medium of the daily press. When the project had taken definite shape, in a bill of incorporation passed by Congress, in which a number of gentlemen on each of the original committees were named as incorporators (several without their request or approval), it was thought that wrangling would cease, and needful preparations be undertaken in ample time to insure success. But the very next step, that of definitely choosing a site, has proved to be even more difficult to agree upon than the first. Considerable time was consumed by the committee on sites in examining the eight or ten locations proposed, any one of which could have been speedily secured, except that in Central Park, the conclusion being finally reached to recommend the latter as the place for holding the exhibition. Here the matter stands at this writing. If Central Park is to be the location, a special permit must first be secured from the city government. Whether this will be granted is a question, to say the least, in serious doubt. The leading New York daily papers are, without exception, opposed to the committees choice of a location, and the city authorities are naturally reluctant to make a concession that does not meet public approval. This seriously hinders the prosecution of the enterprise, and makes it doubtful about completing desirable preparations in the time now remaining. So far as known, not a dollar has been subscribed towards raising the large fund needed to insure success, nor can it be expected that capitalists will come forward and subscribe, until the question of a site is definitely and satisfactorily settled.

The charter requires the fair to be held in the city of New York, but Brooklyn has offered Prospect Park as a location, and a subscription of a quarter of million dollars to have the fair held in that city. If it be held in Central Park, the site cannot be reached directly by water, although it is very desirable that it should be. The convenience of transporting machinery and other heavy objects to and from the exhibition buildings would be greatly facilitated by the selection of a site somewhere bordering on the East or Hudson River. The most weighty objection advanced against such a plan, is, that the site would have to be purchased at considerable cost, while ground in Central Park would be given free. But, as we remarked in our issue of June 12th last, "the people are not likely to favor the surrender of any considerable portion of that pleasure ground for three or four years." The buildings, if located upon any private site, could be made permanent and valuable for business purposes, instead of having to be torn down and taken away, realizing but a small fraction of their cost. The Centennial Exhibition buildings, that were sold and removed, cost *over five million dollars*, and realized only $294,000. One that cost $300,000, sold for $17,000. With this example before the World's Fair Commission, they may properly consider the advantages of a final disposition of the buildings, as well as their first cost of erection and the rental of grounds, before pitching upon a site.

It is to be hoped that but little more delay will be occasioned, as the people of the whole country have an interest in making that fair an eminent success.

Since writing the above the committee has receded from their position upon the Central Park location.

Next week's issue completes Volume III. of the AMERICAN MACHINIST. With greatly improved facilities at our command, we are determined to make Volume IV. superior to anything of the kind in periodical mechanical literature heretofore published.

Laws for Boiler Inspection.

An esteemed correpondent sends us the following urgent appeal for the enactment of a national boiler inspection law:

Shall we have a national law for boiler inspection conducted on scientific principles, and operated by a rigid enforcement of all rules and regulations embodied in the law? I ask this question of the engineering fraternity of this vast country. One more question: Where shall the inspection begin? Shall it be in the shop where the work is first laid out, and while the plates are being prepared for the punch or drill? I answer "Yes" to the last question without hesitation. This inspection should continue from the drawing-room to the plates by hammer test, thence to the punch or drill, the bending, the heating and flanging, and finally, to the assembling and erection of the structure, and the warm water hydraulic test.

The boiler is there set and put to work. How different are the conditions then. The unequal lines of expansion are then rapidly brought into play. Though the boiler may be well set, unequal expansion must certainly take place at several points, and the metal is subjected to a constant agitation, invisible, of course, but "it is there," very much to the injury of the weak places in construction.

The inspection in the shop should be of the most searching character. Then after the first fire is lighted under the boiler we enter upon the second inspection, with the firm belief and understanding that we have a *sound* boiler, both as to material and general construction. We have only then to watch vigilantly the action of the *elements* on the boiler, for they begin to "kill" the boiler the moment the pointer of steam gauge begins its partial or complete traverse of the dial.

It is within the province of the general Government to enact and enforce laws controlling marine boilers and engineers, but if we understand aright the provisions of the United States Constitution the power to prescribe laws regulating stationery boilers and engineers is one reserved to each of the States independently. Most of the States of the Union have, t some time or another, enacted boiler inspection laws but we have yet to learn of one that has accomplished the purpose for which it was placed upon the statute books. Their failure seems to have been due more to political favoritism than to any other cause. Inspectors, in most cases, had first to exhibit political fitness for their positions, and last of all some knowledge of steam engineering. These failures, however, do not prove that boiler inspection laws cannot be adequately enforced. But they do prove that it is impracticable to rely upon Government Officials for thorough conscientious inspection.

Steam boiler explosions are generally simple in their causes, and may almost all be prevented by competent inspection. The most that has been done in that direction in this country, has been by one boiler insurance company. But it is impossible to get every steam user to insure his boiler. In England the Manchester Steam Users Association has successfully existed for twenty-five years, for preventing the sacrifice of human life from steam boiler explosions. It is not managed for profit, has no shareholders, and pays no dividends. At the last annual meeting of this association a resolution was unanimously adopted, from which we take the following paragraph, as giving expression to the views of ripe experience:

The Association considers it imperative that the Government should interfere and enforce the general adoption of competent inspection. The Association, however, strongly objects to the inspection being undertaken by the Government, lest it should interfere unduly with the freedom of the steam user, and recommends that the inspection should be entrusted to local boards formed by steam users themselves, or to private voluntary inspecting agencies, duly authorized and registered; while, as a preliminary step, an Act might be passed providing for a searching inquiry in the event of every steam boiler explosion, whether fatal or not, by a court independent of the coroner's, and more competent to deal with scientific questions.

We have no doubt that such a plan would prove as acceptable and as efficient in this country as in England.

Test of the Anthracite.

In the AMERICAN MACHINIST of Sept. 4, 1880, we described the engines and boiler of the English steam yacht Anthracite, which created such universal interest and admiration. In the article referred to we also called attention to the experiments having taken place at the United States Navy Yard, Brooklyn, and have waited patiently for the results of those experiments to be worked up, to show the true inwardness of the Perkins system of creating and using high pressure steam, or, in other words, from 350 pounds to 500 pounds pressure per square inch. We take pleasure in presenting, on another page of the current issue, a description of the experiments made by a board of United States Naval Engineers, under the able direction of Chief Engineer C. H. Loring. These experiments, though exhaustive, were cut short, somewhat, on account of the limited time allowed before the return of the vessel to England.

In these experiments a comparison has been made between the trial of the same vessel in England by Mr. Bramwell and those that were made in Brooklyn, with a view of ascertaining the correctness of his report. The results of the two trials (which we will publish next week) differ very much, but when the causes are considered, it seems as if the results were sufficiently favorable to warrant experiments being made with a larger steamer. The Anthracite, being a small vessel, does not furnish reliable evidence as to what the results would be with a ship of large dimensions. We hope that the experiments will go on, until the true economy of using steam at high pressures is fully established on its true merits.

We have already presented in these columns most of the papers read before the American Society of Mechanical Engineers, at its first regular meeting, together with the drawings accompanying them. Most of them require more space than we usually devote to single articles, but their recognized value is a sufficient reason for devoting a liberal space for their publication.

Literary Notes.

HANDBOOK FOR STEAM ENGINEERS AND OWNERS OF STEAM ENGINES; being a practical guide to the selection and care of steam machinery. By WM. M. BARR. 12mo, cloth, 132 pages, price $1. Published for the Author by Yohn Brothers, Indianapolis, Ind.

From a casual thought and observation it would appear that engineers are well supplied with pocket books of reference, and this is true. But to gather sufficient practical knowledge from these books to enable a person to form a sufficiently reliable conception of a steam engine, to enable him to realize the requirements of a first-class engine and select the same for use, requires more careful study than most manufacturers are able to give to this subject. It is to fill this vacancy, and by the suggestions of several friends, that Mr. Barr has undertaken the preparation of the book bearing the foregoing title.

While it is intended to instruct the practical engineer, it is also capable of furnishing manufacturers with reliable ideas, as to the true inwardness of the machine which bears so important a relation to the economical management of a large manufacturing business.

When it is considered that a large portion of the vast number of small engines, which have been put into use in furnishing small power throughout the country, are run by men who are inexperienced in the management of the steam engine, it will readily be seen that an instructor for this class is necessary. This book, though small, is a condensed treatise on the steam engine, and a person is not obliged to read several pages to get an idea. No words are wasted, and this will be found valuable particularly to farmers, who must have engines, whether they know how to use them or not. All details and illustrations have been carefully avoided, as they are considered of small value to steam users. The chief objects of

the book are to assist the reader in the selection of, and care in using, steam machinery; and, believing that it will accomplish all this, we commend it to our readers.

ENCYCLOPEDIA OF PRACTICAL RECEIPTS AND PROCESSES. Containing over 6,400 receipts, embracing thorough information in plain language, applicable to almost every possible industrial and domestic requirements. By William B. Dick. Third edition; royal octavo; cloth; 607 pp; price, $5.00. Published by Dick & Fitzgerald, 18 Ann street, New York.

Many books have been written upon scientific recipes and processes, and in many cases they have been little more than reprints from previous editions, with some slight alterations and additions. Most of the valuable matter is placed together in such a way that it cannot be indexed, and if it was there would be great difficulty in finding what was wanted. The peculiarities of Mr. Dick's book is that the matter it contains is that which is not easily obtained, and many of the recipes and processes were never published before in any other book.

The tables of weights and measures, and the accompanying matter, have been prepared by a competent mathematician. One of the chief characteristics of this book is that the formulas and technicalities of experts, wherever made use of in this book, has been reduced to plain language, so that it may be understood by any one who can read. We are glad to see so few repetitions, as all the matter published under its proper head, but referring to other portions of the work, is designated by reference marks, thus avoiding repetition.

Each subject is properly indexed, so that when a person wishes to find anything, the index is of great value, while with many similar books this portion of the work has been sadly neglected, to the disgust of the reader.

The most desirable and necessary feature in a book of this kind is a reliable index. Most of the valuable foreign and domestic technical books and manuals of the modern arts and sciences have been carefully read, and a large portion of practical information has been collected and condensed into the most available form for use.

A full list of the authorities quoted are given, which being of a high standard, is also a guaranty for the correctness of the matter published. The processes and formula pertaining to the laboratory and workshop are of the most practical character, many of which are illustrated by neatly-executed engravings and diagrams.

For the medical department the author claims to have adopted each receipt or formula for its efficacy only, without reference to any particular school of medicine. Many of these are taken from the diary of a physician, and were never before published. This book is well printed, and has been used for some time by the leading manufacturing chemists and druggists, and we have full confidence that our readers will appreciate the contents of so valuable a publication.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) W. M., Niles, Michigan, writes: I should like some information in regard to the method and materials used in case hardening small work, such as set screws, made of wrought iron. They are better than steel set screws when properly hardened, as they are hard on the point and outside surface being soft and tough within. *A.*—We described the process of case hardening in the AMERICAN MACHINIST of Nov. 8, 1879, which number we can furnish you. The whole secret of case hardening successfully lies in the fact that the operation requires the articles to be placed in an iron box, and in contact with animal charcoal or carbon. The box should be air tight, the circulation of heat should be uniform all about the box, and the heat should be gradually raised and kept at a sufficiently high temperature to allow the articles to absorb the carbon freely. The chief cause of failure is in a fluctuating and insufficient heat. The articles should be dropped directly from the box into water without coming in contact with the air.

(3) H. E. G., Allegheny City, Pa., writes: It may not be out of order to inquire whether the thousands of readers, who prize and preserve each copy of your valuable journal, may look to the new volume as one paged continuously, and the information indexed as often as every six months. Believing that you are ever ready to please your patrons, I feel confident that the above suggestion will merit your consideration. *A.*—The answer to this question will also be an answer to many others of similar import received by us. We have carefully considered the question of continuous paging of all the numbers comprising the volume, and, after weighing thoroughly all the arguments presented in favor of and against the proposed system, we have seen no cause to change our present method in this respect. The AMERICAN MACHINIST is intended to be a record of current mechanical thoughts and events, each number being, so far as is possible, complete in itself. The present system of paging presents no obstacle to indexing or binding, a large part of our edition being now regularly bound and preserved, while for current reading purposes, looking for an article on the 3th or 5th or 8th page of any weekly issue is much more easy and satisfactory than the effort to remember the precise page, many numbers back, in which the article sought for is indistinctly known to have appeared, thus avoiding much confusion that would otherwise occur. Regarding index, we shall endeavor to supply, with the closing number of each yearly volume (next week's issue will complete the present volume), a convenient index, that will afford every possible clue to the several subjects treated. As our volume begins and ends with the year, it would be misleading should we index every six months.

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Blowers for all purposes. Exeter Machine Works, 50 Federal Street, Boston.

See Christiana Machine Co.'s adver., last number.

James W. See, Designing and Consulting Engineer, Hamilton, Ohio.

Howard S. Abbot, Attorney at Law and Solicitor of Patents, 617 7th Street, N. W., Washington, D. C. Personal attention given to cases in Patent Office.

J. C. Hoadley, Engineer and Expert, formerly of Lawrence, Mass., has opened an office at 29 High St., cor. Federal, Boston, Mass., where he will be pleased to receive old and new friends.

MANUFACTURES.

The Cape Ann Forge Works, of Gloucester, Mass., have just begun operations in a new shop, equipped with a new engine, boilers, and other machinery.

Clarksville, Mo., is to have a paper mill—the only one in the State.

The old repair shops of the New York and New England Railroad at Readville, Mass., have been leased by the Globe Rubber Co. of Boston, who have the privilege of purchasing at a cost of $20,000, and will employ a large number of hands.

Griffith & Wedge, Zanesville, O., are extending their machine works.

The work upon the rolling mill at Sacramento, California, is progressing rapidly. The main building is completed, and the works will be ready for occupancy early next spring.

The story is again revived of an effort to buy the Wheatland, Pa., rolling mill, this time by Cleveland capitalists.

The Pottsville Iron and Steel Co. is a new concern for the manufacture of iron and steel at Pottsville, Pa.

The Ansonia Clock Co., Brooklyn, N. Y., whose works were recently destroyed by fire, are about to rebuild on the former site. The main building will be ready for work about Jan. 1.

The Ames Manufacturing Company, Chicopee, Mass., are hurrying up their new building for the manufacture of sewing machines.

J. W. Gardner, of Shelburne Falls, Mass., is erecting a new cutlery factory, which will furnish room for the employment of about 300 men.

Edward Wright & Co., Worcester, Mass., have erected a new building for a machine shop, which they will soon occupy.

The Worcester (Mass.) Wire Company are enlarging their works by the erection of a brick building 188×46 feet, two stories high.

The Cleveland Machine Works, Worcester, Mass., have just completed a one-story addition to their shop, 60×35 feet.

David Whitcomb and Stephen Salisbury, of Worcester, Mass., have promised to pay the expense, estimated at $12,000, of enlarging the Washburn Machine Shop, connected with the Worcester County Free Institute of Industrial Science.

A number of Akron capitalists contemplate the occupation of the present Empire Reaper Works with a portable engine manufactory, as soon as Mr. Seiberling moves out.—*Cleveland Trade Review.*

The buildings of the new agricultural works at Akron, O., are going up rapidly.

According to the *Paper World*, many new paper mills are now being erected in different parts of the country.

The Pratt & Whitney Co., Hartford, Conn., write us under date Nov. 26:

Our business is still driving us beyond our ability to meet the demand. We have been obliged to add about forty-five per cent. to our finishing department. The new shop now being built will be 144x46, and three stories high; expect to occupy it about March 1.

A Boston correspondent sends us the following item, in regard to the action of a large machinery establishment, which we commend to others as worthy of imitation:

The employes of the Whittier Machine Company were each treated, as last year, with the present of a fine turkey for Thanksgiving, showing that the proprietors were not unmindful of the desires of their workmen. Few fare better. Not only has turkey been distributed, but wages have been advanced to all workmen, in proportion as they have shown themselves deserving during the year past. Besides this, another source of gratification to workmen, as well as of benefit to the proprietors, is the many improvements being carried out in the way of building, and extending the shop to get more room, and the putting in of windows and skylights, and the generous use of the *whitewash brush* throughout the premises, giving more and better light. No one can better appreciate this kind of improvements about the workshops, than the workman who has to occupy the premises during ten hours out of the twenty-four.

Steps have been taken to build a new railroad in connection with the Lake Shore and Michigan Southern from Toledo to some some point on the track of the latter within a hundred miles of Chicago. The work will begin at once.

Newly-Incorporated New York Companies.

Oneida Community, Limited, of Community, Madison county. Albert Kinsley, Henry W. Burnham, and others, incorporators. Capital, $600,000, in shares of $25 each. For the purpose of carrying on a general manufacturing and agricultural business. Filed Nov. 20, 1880.

Davidson Steam Pump Company, Brooklyn. Marshall T. Davidson, Richard K. Sheldon, and others, incorporators. Capital, $100,000, in shares of $100 each. For the manufacture and sale of steam pumps, pumping engines and hydraulic machinery. Filed Nov. 20.

Poughkeepsie Glass Works, of Poughkeepsie, N. Y. Wm. C. Ely, C. W. Reed, and others, incorporators. Capital, $85,000, in shares of $100 each. For the manufacture and sale of glass and glassware in its various departments and methods. Filed Nov. 20.

Columbia Chemical Works, of Brooklyn, N. Y, Chas. Chauncey Parsons, Wm. I. Parsons, and others, incorporators. Capital, $3,600, in shares of $100 each. For the manufacture and sale of chemical products. Filed Nov. 22.

The Reliable Ice and Refrigerating Machine Company, of New York. Alexander T. Ballantine, Robert A. Ripley, and others, incorporators. Capital, $500,000, in shares of $25 each. To build, erect and sell machines for the purpose of manufacturing artificial ice and refrigeration. Filed Nov. 23.

The Gouge Heating and Ventilating Company, New York. Henry A. Gouge, Samuel Shethar, and others, incorporators. Capital, $100,000, in shares of $100 each. For the manufacture and sale of machines and apparatus for heating and ventilating buildings, cars, vessels, etc. Filed Nov. 23.

"Myers' Sanitary Depot," New York. Lucien Knapp, Fred. W. Klabfleisch, and Andrew G. Myers, incorporators. Capital, $20,000, in shares of $100 each. For the manufacture and sale of plumbing materials, and pottery, and general wood and metal work. Filed Nov. 24.

W. B. Smith & Co., New York. Wm. B. Smith, Edmund B. Barnum and others, incorporators. Capital, $25,000, in shares of $100 each. For the manufacture, publication and sale of books and other publications. Nov. 26, 1880.

Niello Enamel and Bronze Company, New York. A. B. Tripler, Chas. S. Cohen and others, incorporators. Capital, $50,000, in shares of $50 each. For the manufacture and sale of Niello enamels and bronze work, electro-plating, and all similar work. Nov. 26, 1880.

American District Steam Company, Lockport, N. Y. Isaac H. Babcock, David F. Bishop and others, incorporators. Capital, $10,000,000, in shares of $100 each. For the manufacture and sale of machinery, contrivances, apparatus, and other things necessary and needful in supplying hot or cold water and air, steam or other fluid, for heating, cooking, or other useful applications. Nov. 27, 1880.

The Kamak Cutlery Company, Limited, New York. Bertha Kamak, William Roger and others, incorporators. Capital, $10,000, in shares of $50 each. For the manufacture, purchase and sale of cutlery, hardware and fancy goods, and for exportation and importation of same. Nov. 27, 1880.

The Cylinder Lock Company, New York. Henry Phillips, A. Henry Elliott and others, incorporators. Capital, $200,000, in shares of $20 each, For the manufacture and sale of locks, small hardware, and other articles of use and novelty. Nov. 29, 1880.

The Pleasure Seekers' Manufacturing Company, New York. I. N. Forrester, Jas. W. Guernsey and others, incorporators. Capital, $30,000, in shares of $100 each. For the manufacture and sale of Forrester's Patent Frictional Swing, and other appliances and apparatus for the amusement of pleasure seekers. Dec. 1, 1880.

Machinists' and Engineers' Supplies.

NEW YORK, December 2, 1880.

The general state of the supply market still remains good; all the dealers are doing a fair and satisfactory business.

We hear of no changes in values, and goods are more easily obtained now than they have been for several months past.

Eaton, Cole & Burnham Co. 58 John St., New York, have just issued a new catalogue and price list of 48 pages containing descriptions and prices of their goods and specialties. The above price list is accompanied by a discount sheet.

Iron Review.

NEW YORK, December 2, 1880.

The iron market, although far from being brisk, yet a fair business has been done in small lots, and the condition of the market is decidedly stronger than last reported. The prospects for a good year's business after the holidays are excellent, and many think the demand will occasion advanced quotations. Most of the sales made have been for the use of consumers. Prices are unchanged, and we continue to quote as follows: Foundry No. 1, $25; Foundry No. 2, $21, and Gray Forge, $20.

The sales of steel rails and of railroad equipments generally, during the past week, have been enormous; but for low prices abroad and foreign stocks here, the market would advance materially. Old rails are held firmly at about $26.50, and the stock here has been reduced considerably by recent sales. Pig Iron is firm.

American Iron Rails, $50 to $53, according to weight; Fish Plates, 2½c. per lb.; Railway Spikes, 3¼c.; Bolts and Nuts, 3½c.; Common Bar Iron, 2.3c., basis from store, Refined do. 2.5c., basis; Ulster, 3 6-10 basis; Machinery Steel, 6½c.; Best Tool Steel, 13¼c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 6¾c.; Sheet Iron, 3½c., basis; Angle Iron, 3c.; Tee Iron, 3½c.; Band Iron, 3 2-10c.; Hoop Iron, 3.5c., and up according to size; Horse Shoe Iron, 3 2-10c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies from store as follows:

Flange Iron	5¼
C. H., No. 1, Shell Iron	4¼
C. No. 1 Iron	4
Tank Iron	3¾
Sheet Iron	3½
Angle Iron	3½
Bead Iron	5½
Burden Boiler Rivets	5 1-10

Boiler Tubes at 40 per cent. discount off list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of Dec. 2, 1880:

The metal market without material changes since our last. Pig Tin. £94 10s. in London; $29.25 in Singapore The home market we quote nominally: Banca Tin, 25c.: Malacca and Straits 21½c. and upward, Australian and Billiton 21c.; "Lamb & Flag," 20¾c. to 21c; Bar Tin, 22c. and upwards. Lead, 5c.; Antimony, 15c. to 16c. as to brand. Spelter, 5¼c. and upward for American. 8¼c. and upwards for "Bertha," pure; Solder, No. 1, 11½c.; "Half and Half," 13¼c.; Bismuth from $2.50 upward.

WANTED.

Parties desiring a competent man to superintend the erection of engines or machinery, address J. F. Kingsley, Box 777, Owego, Tioga Co., N. Y.

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TO WHOM IT MAY CONCERN: New York, May 1st, 1877.
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We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.
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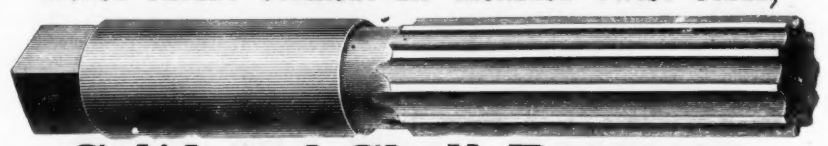

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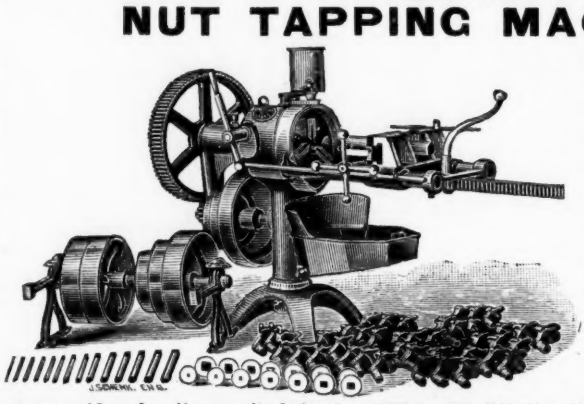

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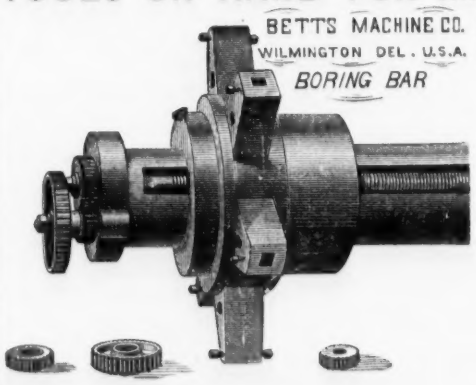

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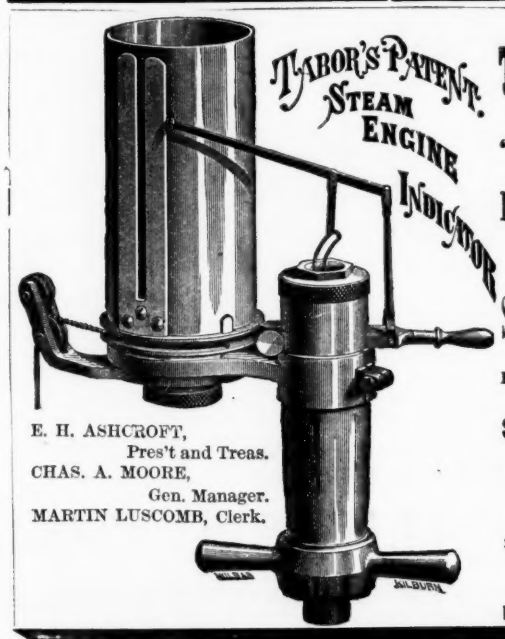

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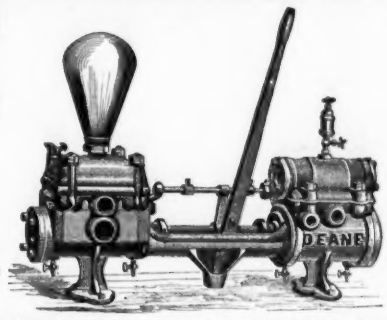

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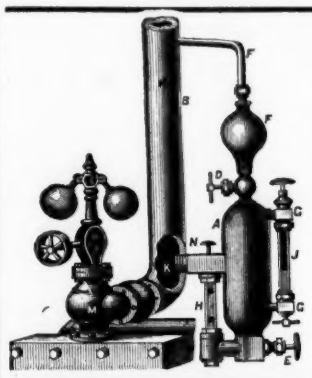

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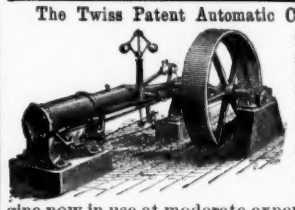

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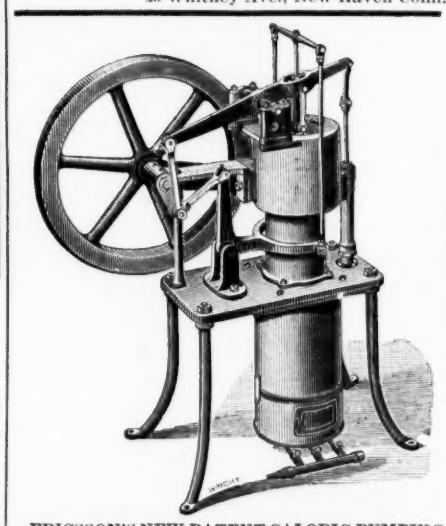

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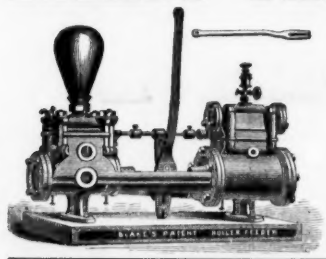

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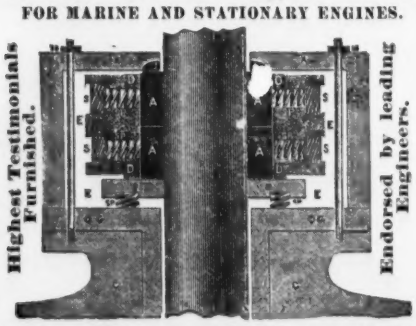

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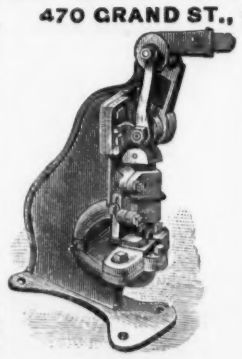

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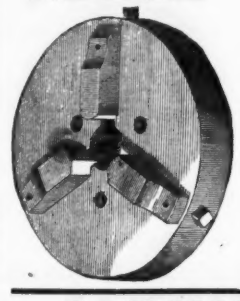

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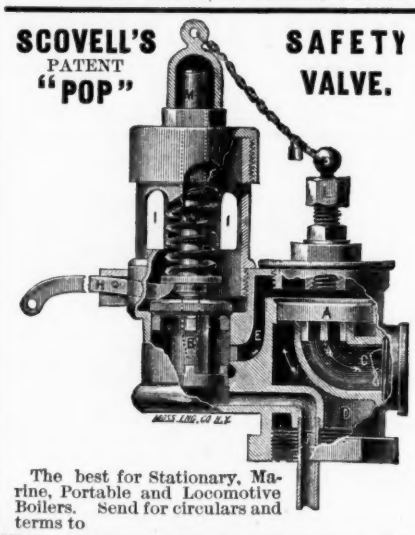

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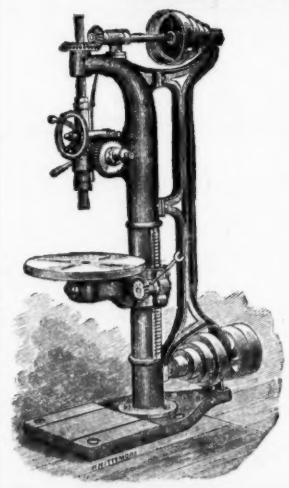

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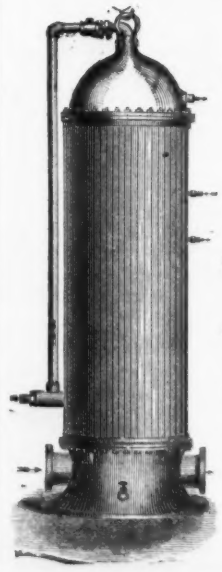

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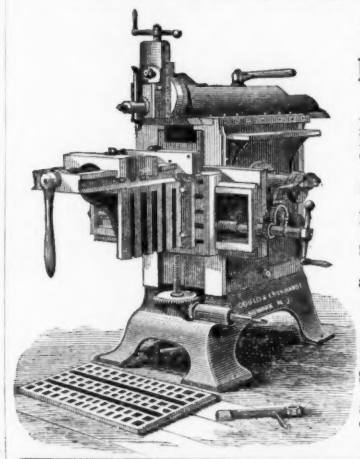

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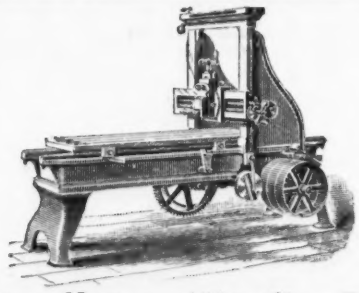

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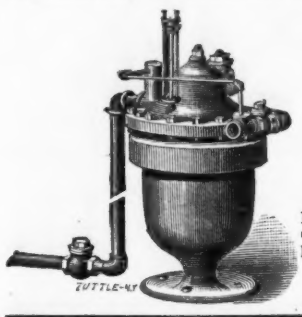

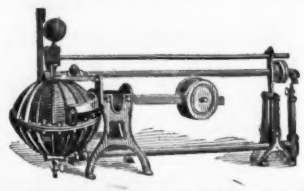

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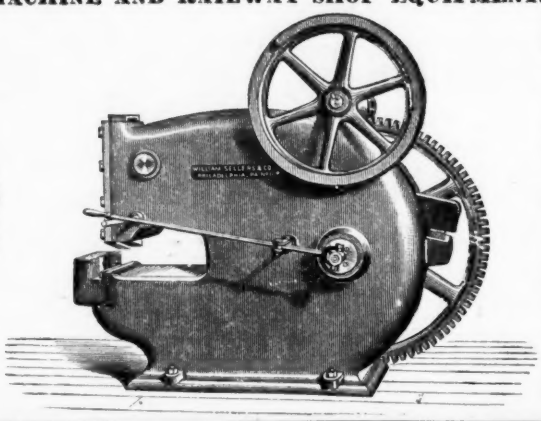

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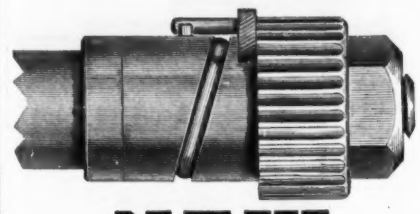

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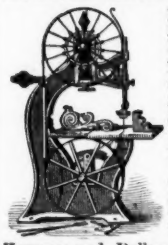

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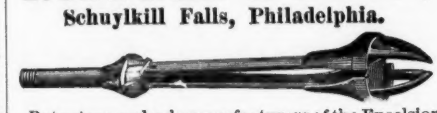

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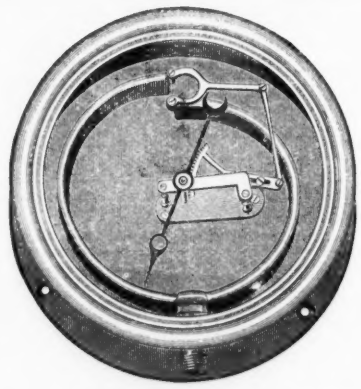

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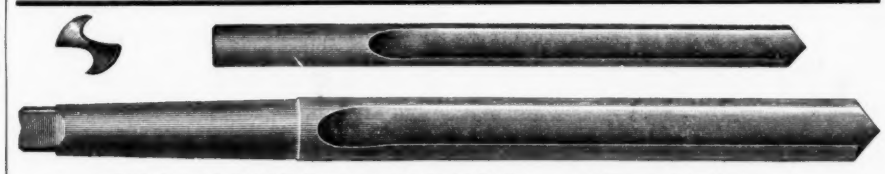

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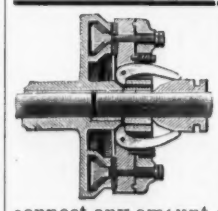

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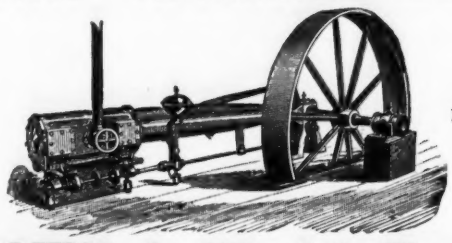

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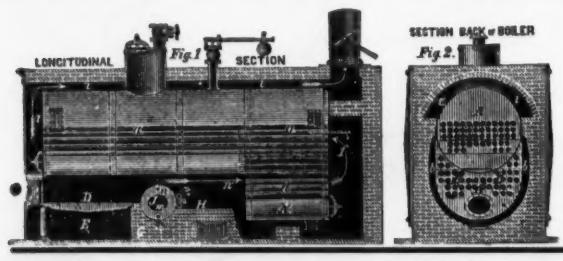

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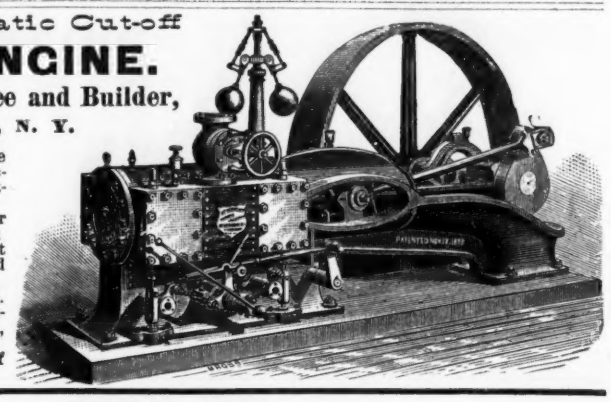

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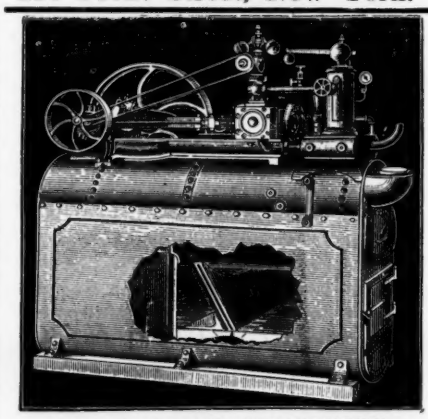

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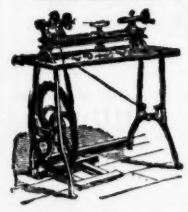

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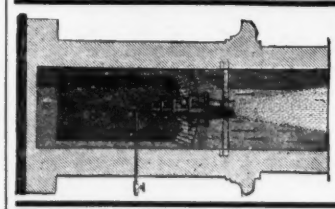

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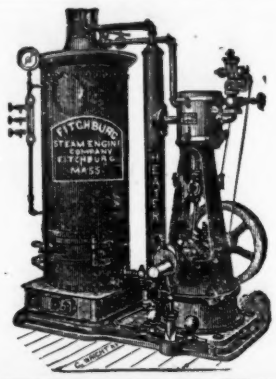

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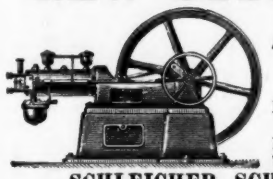

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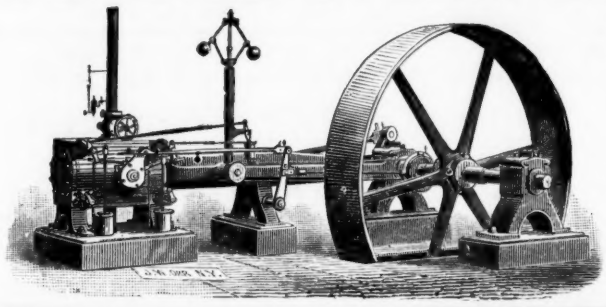

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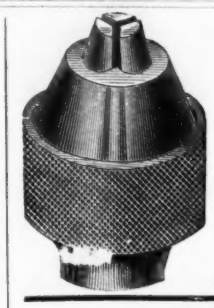

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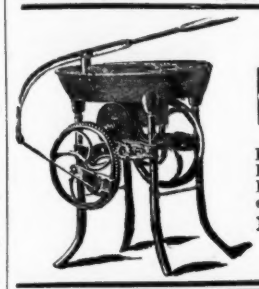

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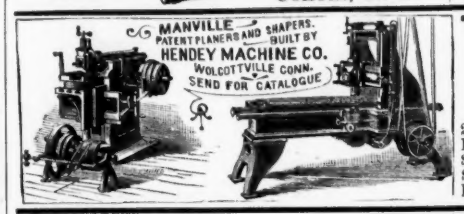

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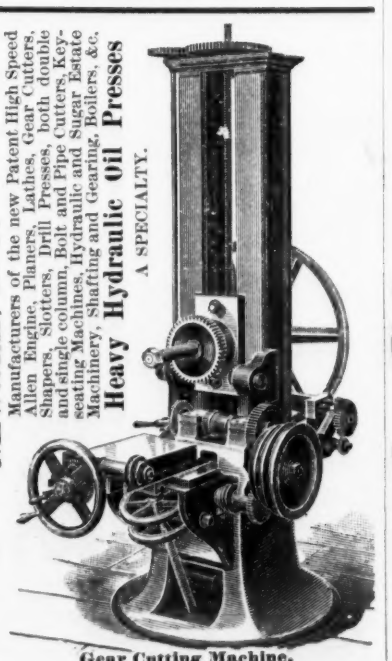

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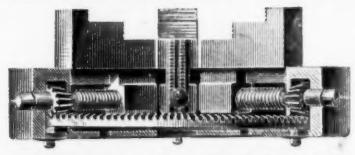

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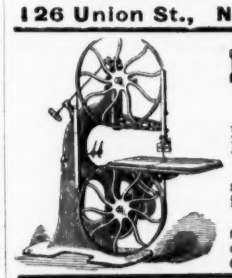

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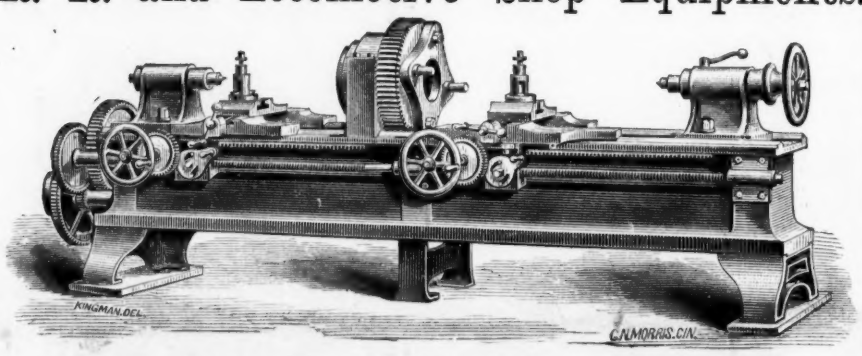

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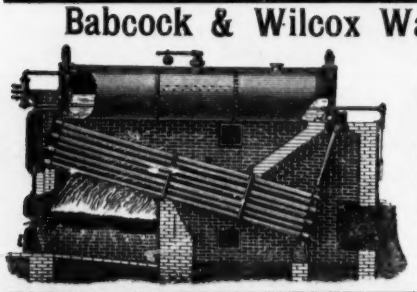

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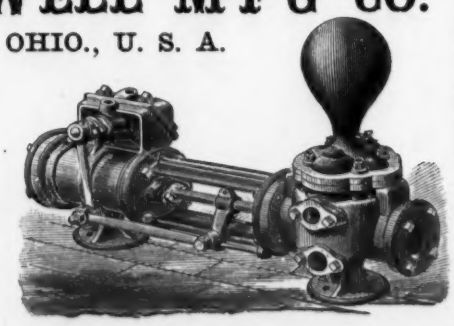

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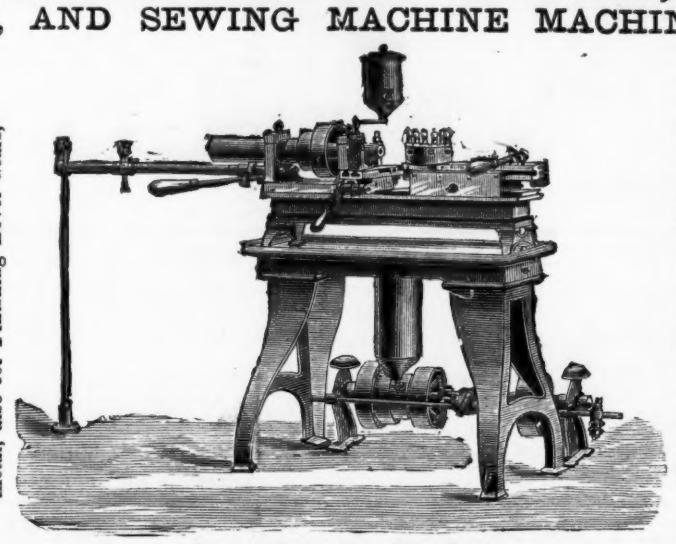

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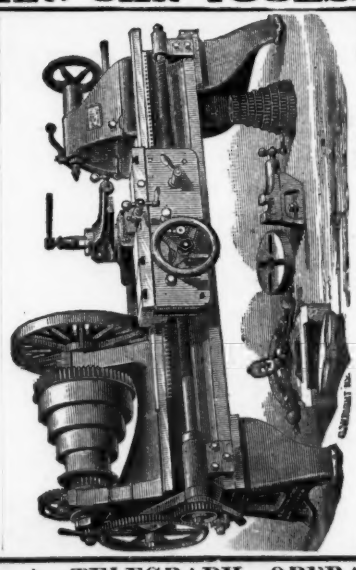

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